NULATO RIVER SALMON ESCAPEMENT PROJECT, 2003

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THE OEO STATEMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

Chinook and summer chum salmon migrating into the Nulato River were counted using a resistance board weir to enumerate the spawning abundance in 2003. Before 1994, salmon escapements to the Nulato River were previously indexed only by aerial surveys. Beginning in 1994, a cooperative tower counting project was formed by the Tanana Chiefs Conference Inc., Nulato Tribal Council and the Alaska Department of Fish and Game. The Nulato Tribal Council and the Alaska Department of Fish and Game estimated the daily passage of summer chum salmon *Oncorhynchus keta* and chinook salmon *O. tshawytscha* using visual observations through a weir from July 5 to July 22, 2003. Counting periods that were missed, were interpolated for chum salmon and chinook salmon. Total estimated escapements into the Nulato River were 1,997 chinook salmon and 19,590 summer chum salmon. Observations of commercial harvests and other escapement projects indicate that chinook salmon to the Yukon River were near average but the summer chum run was below average. Escapement goals were generally achieved throughout the Yukon River drainage for chinook but fell short for summer chum salmon.

KEY WORDS: Chinook salmon, summer chum salmon, Nulato River, resistance board weir, commercial, harvest, aerial survey, Yukon River, Tanana Chiefs Conference, Nulato Tribal Council

INTRODUCTION

The goal of the Nulato River Weir project is to provide area managers an inseason escapement index for the upper portion of the Yukon River District 4 management area. This project also assesses the age and sex composition of the summer chum salmon escapement into the Nulato River.

Historical aerial survey indices indicate the Nulato River may be the largest producer of summer chum salmon above the Anvik River (Sandone 1995). Spawning chinook salmon also utilize the Nulato River. Some pink and coho salmon have been reported to spawn in the Nulato River but do not spawn in significant numbers. Management of subsistence and commercially targeted salmon species requires reliable run strength and run timing information from harvests and escapement information as salmon migrate through Yukon River districts. Ground based escapement projects throughout the Yukon River drainage are typically operated on tributaries that are easily accessible and/or are considered to be an important spawning tributary. These escapement projects provide researchers and managers quality escapement information and age, sex, and size information that can be used for management of Yukon River salmon resources.

Nulato River escapements were previously indexed using aerial survey methodology. Aerial survey methods are inexpensive compared to ground based projects but they sacrifice timely and quality information. Aerial survey indices are susceptible to a host of negative factors, which influence the quality of the data, therefore do not provide accurate escapement estimates of chinook or summer chum migrating into the Nulato River. There is a lack of quality historical escapement information for Nulato River chinook and summer chum salmon. Without this information, determinations of what the escapement objectives should be and whether escapement objectives are being met in this portion of the Yukon River, are difficult to ascertain. Pilot Station Sonar, test fishing indices, age and sex composition information, and commercial and subsistence harvests provide run strength and run timing information of salmon migrating up the Yukon River mainstem. However, these assessment projects and their indices do not provide quality escapement information for specific tributaries being used to index salmon runs in various districts of the Yukon River.

The Yukon River drainage supports major stocks of chinook salmon *Oncorhynchus tshawytscha*, summer and fall run chum salmon *O. keta*, and coho salmon *O. kisutch*. These species contribute to commercial and subsistence fisheries throughout the Yukon River drainage. Pink salmon *O. gorbuscha* and sockeye salmon *O. nerka* are also indigenous to the Yukon River. Pink salmon return to lower drainage tributaries and typically have stronger runs in even numbered years. Sockeye salmon are documented less frequently. Neither of the two later species are harvested commercially or targeted to any extent for subsistence use. Summer chum salmon are distinguished from fall chum salmon by their earlier entry timing (early June to mid-July) into the Yukon River. Summer chum salmon are smaller in size with spawning distributions into lower and middle Yukon River drainages. Fall chum salmon enter the Yukon River from mid-July to the first of September, are larger, and spawn primarily in middle to upper portions of the Yukon River drainage.

Before 1994, relatively few projects provided spawning escapement information for the various Yukon River salmon stocks. Lower river test fishing catch rates, inseason passage estimates from Pilot Station Sonar (rkm 198) and the Anvik River sonar project (rkm 587) provided most of the available information used to make management decisions concerning commercial and subsistence harvests of summer chum salmon in District 4 (Figure 1).

Salmon returning to the Nulato River are most likely harvested in commercial and subsistence fisheries in coastal areas near the Yukon River delta and throughout the mainstem Yukon River. These areas include the Coastal District, Districts 1, 2, 3, and most of District 4 (Figure 1). There was not an inseason salmon escapement, monitoring project within the upper portion of District 4 to serve as an index for run size and quality (sex composition) of spawning escapements in that portion of the river prior to the Nulato River tower project. Federal agencies and private organizations have increased their involvement and participation by developing and implementing additional spawning escapement and assessment projects. These projects provide managers inseason escapement information necessary to manage for escapements. Operation of an inseason escapement monitoring project for summer chum salmon within the upper portion of District 4 would serve as an index for the middle Yukon River area and provide fishery managers additional information concerning the size and quality of spawning escapement in this area. Additional stock identification studies for mixed stock fisheries could provide information to develop stream specific biological escapement goals.

A thorough review of the Nulato River and probable contribution of salmon production from this tributary to the Yukon River is presented in the report *Nulato River Salmon Escapement Project, 1994* (Sandone 1995), which was the first year of operation. With the exception of 1995, Nulato River salmon escapement reports have been written annually (Headlee 1996; Paulus 1997; Paulus *et. al.* 2001; Lingnau and Der Hovanisian 2001, Lingnau and Moore 2002; and Lingnau 2002a, 2002b, 2002c). The 1995 field project data was reported only as a brief summary by Paul Headlee, Water Resource Specialist, TCC. This report presents information gathered during the 2003 field season.

Nulato River Escapement Assessment

The Nulato River is one of the department's primary aerial survey index areas for assessment of the relative abundance of chinook and summer chum salmon spawning escapement. All escapement goals pertaining to the Nulato River were, and presently are, based on aerial survey counts of salmon.

Under the Policy For Statewide Salmon Escapement Goals (5 AAC 39.223), the Department of Fish and Game and the Board of Fisheries are charged with the duty to conserve and develop Alaska's salmon fisheries on the sustained yield principle. Therefore, the establishment of salmon escapement goals is the responsibility of both the board and the department working collaboratively. The purpose of this policy is to establish the concepts, criteria, and procedures for establishing and modifying salmon escapement goals and to establish a process that facilitates public review of allocative issues associated with escapement goals.

The department's responsibility is to (1) document existing salmon escapement goals for all salmon stocks that are currently managed for an escapement goal; (2) establish biological escapement goals (BEG) for salmon stocks for which the department can reliably enumerate salmon escapement levels, as well as total annual returns; (3) establish sustainable escapement goals (SEG) for salmon stocks for which the department can reliably estimate escapement levels when information is insufficient to enumerate total annual returns and the range of escapements that are used to develop a BEG. No BEG or SEG has been established for the Nulato River summer chum salmon stocks, because there is a lack of information.

A chinook salmon aerial survey based escapement goal range of 400 to 1,100 was proposed in 1981 for the entire Nulato River (Buklis 1993). Similar to summer chum salmon aerial survey goals, this goal went through several changes (Sandone 1995). Chinook salmon escapement goals for the Yukon River were reevaluated in the spring of 1991 and were in effect for the 1992 season (Buklis 1993). At that time, minimum interim escapement goals for chinook salmon, based on aerial survey counts, were established for both forks: 800 chinook salmon for the North Fork and 500 chinook salmon for the South Fork. Under the escapement goal policy, these goals were redefined as SEGs. Information from the tower and weir counting projects may be used to re-evaluate the escapement objectives for the Nulato River in the future.

Study Area

The Nulato River is a narrow river with a substrate consisting mainly of gravel and cobble. The river is formed from two main branches, the North Fork and South Fork, which converge approximately 9 kilometer (km) above its mouth. Both forks of the Nulato River originate at an elevation of approximately 600 meter (m). From its source, the South Fork flows in a northeasterly and easterly direction about 98 km to the confluence with the North Fork. From its source, the North Fork, mostly flows in a northeasterly and easterly direction and is approximately 114 km long. The North Fork drainage includes the Kalasik Creek drainage, approximately 54 km in length. The mainstem Nulato River joins the Yukon River at km 777 at an approximate elevation of 33 m (Sandone 1995).

The Nulato River weir site was located approximately 6.5 km upstream from the confluence with the Yukon River (Figure 2). The weir site was about 1.5 km upstream from the 1994-2002 tower site. The water is typically clear with some brown (tannic) staining from peat and organic material. Most chum salmon spawning areas were upstream of the current weir and former tower sites.

Objectives

The objectives of this study were to:

1. Estimate the total escapement of summer chum and chinook salmon into the Nulato River using weir-counting methodology.
2. Estimate the age, sex, and length (ASL) composition of the summer chum salmon spawning population.

3. Monitor climatological and hydrological conditions at the weir site.

METHODS

Site Selection and Preparation

Two potential weir sites were located in the fall of 2000. Site 1 was 0.2 km downstream of the confluence of the two forks and 7.2 km upstream from the confluence of the Nulato and Yukon River. Site 2, was 1.6 km downstream of the tower site and 4.0 km above the Yukon River confluence. Observations during the beginning of the 2002 field season indicated the 2001 flood may have changed the channel characteristics and a second reconnaissance trip was planned.

The current weir site was selected at the end of the 2002 field season (Figure 2) after completing a reconnaissance of the mainstem Nulato River. The criteria used for site selection included: 1) location below most chum salmon spawning areas; 2) a single, relatively narrow channel; and 3) relatively shallow river depth to facilitate observation of migrating salmon through the exit gate in the weir. The 2003 weir site had cut banks on both sides of the river. The right bank dropped off sharply and the left bank was more gradual. A river bottom profile was measured to determine the best place to position the weir (Figure 3).

Escapement Estimation Sampling

In response to the 1993 Western Alaska chum salmon failure, the Western Alaska Disaster Grant (WADG) funded numerous projects to assess salmon runs in Western Alaska. Part of this funding was dedicated to construct a floating weir to be used on the mainstem of the Nulato River. The tower project, operated from 1994 through 2002, provided quality and escapement abundance of summer chum salmon. However, abundance of spawning chinook salmon was obtained by aerial survey, and few chinook salmon were captured in beach seines for ASL information. By installing a weir on the Nulato River, it was hoped that quality abundance estimates and ASL data of both chinook and chum salmon could be improved.

Weir Design

The weir spanned a 79.3 m (260 ft) channel and consists of about 76.2 m (250 ft) of resistance board panels and 3.0 m (10 ft) of fixed steel pickets. The steel pickets were hammered into the substrate along the river margins where the slope of the channel shallows towards shore. The fixed steel pickets were joined to the resistance board weir with floating bulkheads.

The resistance board panels were designed based on a style developed by the USFWS (Tobin 1994). The primary difference was that each panel was 36 in wide. Another difference was that the edges of the plastic stringers were rounded to reduce the likelihood of abrading fish. The spacing between pickets was 1 5/8 in. The pickets had some flexibility, but the narrow spacing

allowed for a complete census of all but the smallest returning salmon. Small resident species were able to slip through the panels.

A passing chute / live trap was positioned on the upstream side of the weir where most of the salmon were traveling. This was typically near the deepest part of the channel. The trap frame was constructed from aluminum angle and channel stock and measured 5 ft (width) by 8 ft (length) by 5 ft (height). The trap floor was welded from perforated aluminum sheet. The sides were constructed of vertically positioned one inch IMC galvanized aluminum conduit (1 $^{5}/_{16}$ in outside diameter). Spacing between the conduit pickets was 2 3/4 in, but the rigidity of the conduit and narrow spacing allowed for a complete census of the salmon. The trap had a collapsible V-shaped entrance and a removable 16-in wide exit gate. In addition, a second exit gate was hinged near the base of the removable gate. When water clarity was diminished, the hinged gate, on the outside of the trap, was partially raised to direct fish closer to the surface for better viewing. Side panels flank the hinged gate to keep fish within the viewing area. The trap was joined to the weir by floating bulkheads constructed of the same material as the weir panels.

Weir Installation and Operation

The target date for weir installation was June 26 with tentative operating dates from June 29 through July 26. This period of operation spans the majority of the salmon migration returning to the Nulato River.

All fish passing upstream through the passage chute / trap were enumerated by species. Each day the entrance of the trap was opened by 0700 hours to allow fish to enter the holding pen. If fish were not needed for ASL sampling, the exit gate was opened to allow fish to pass upstream. The hinged gate was adjusted to ensure that fish could be identified by species, but without causing an undue obstacle for the fish. The technician was positioned above the exit gate and enumerates passage with zeroed multiple tally counters. The technicians were instructed to be quiet and keep motion to a minimum to avoid alarming fish. Enumeration continues for 30 min, or until passage wanes to near zero, then the exit gate was closed. The technician immediately recorded the fish passage into a Rite-in-the-Rain notebook. This procedure was repeated five times throughout the day; even when passage was slow, to allow fish to pass upstream. The five scheduled 30-min counting periods each day were at 0700 hours, 1100 hours, 1530 hour, 1800 hours, and 2100 hours. Counts for the day were tallied on the Nulato River weir salmon passage log in the project notebook.

Cleaning and checking the weir for holes was performed daily after 1530 hours or more frequently as needed. Cleaning consists of walking across the weir to partially submerge each panel and allow the current to wash debris downstream. Algal growth was removed periodically by scrubbing the pickets with a long-handled push broom.

In addition to cleaning, the technician periodic used snorkel gear to check the integrity of the weir and substrate condition. Any holes and scoured areas were repaired immediately.

Boats could pass over the Nulato River weir at a designated 'boat gate' located near the thalweg

of the channel. The boat gate consisted of a section of three resistance board panels, each with a 2-ft by 3-ft sheet of ½-in high-density polyvinyl plastic secured to the upper surface of the distal end of the panel. The plastic sheet helped to protect the panels from the abrasion of passing boats. The resistance boards on these panels were left flat so that the distal end of the panel dips close to the surface of the water. The weight of a passing boat caused these panels to submerge. The panels resurface once the boat had cleared the gate. During average water levels, jet-drive boats were generally used above the weir site. Jet-drive boats could pass upstream and downstream over the boat gate with no special requirements other than reducing their speed. No propeller-drive boats traveled above the weir site due to the shallow depth of the river.

Interpolation for Missed Counts

Where possible, counts that were missed were interpolated by taking the average of the count for the same hour on the day before and the day after the missed count. In this analysis, no adjustments were made for breached counts.

Age-Sex-Length Sampling

When the Nulato River tower project was initiated in 1994, dates needed to be established to define sampling strata for collecting age-sex-length (ASL) information. Run timing information did not exist for the Nulato River. Aerial survey information indicated that the timing of peak abundance for summer chum salmon in the Nulato River was historically similar to that of the Anvik River, for which sonar daily passage estimates were available dating back to 1979 (Sandone 1995). Strata periods were initially selected for the Nulato River based on those used for the Anvik River: early (June 22 to July 5), early-middle (July 6-9), late-middle (July 10-14), and late (July 15-25) (Sandone 1995). These strata were altered postseason to increase the number of samples used for each stratum.

The sample goal for each species was based on 95% precision with 10% accuracy for each time stratum. The season ASL sample goal was set at 608 chum salmon and all chinook salmon, with 152 chum salmon sampled in each of the strata described above. The 152 summer chum salmon per strata would yield a total sex ratio sample goal of 608 fish for the season on the Nulato River to define the quality of the escapement.

Only a few chinook salmon escapement samples are collected annually at Nulato River. Chinook salmon have been difficult to capture at this site and all attempts thus far have yielded few fish.

The fish chute / trap in the weir was used to catch salmon for ASL samples. Data such as date, time, number, and sex of fish were recorded. Captured salmon were identified by species and sex, measured to the nearest 5 mm (mid-eye to fork-of-tail), sampled for scales and adipose fin-clipped to prevent re-sampling. Scales were taken from an area posterior to the base of the dorsal fin and above the lateral line on the left side of the fish (Clutter and Whitesel 1956). One scale was taken from chum salmon and three scales were taken from chinook salmon. Scales were wiped clean to remove slime and tissue and affixed to a gum-surfaced scale card with numbers

that corresponded to recording form. The scales were processed and aged postseason, and ASL data compiled and summarized.

Fin Clips for DNA Analysis

The Nulato River weir crew also collected fin clips from adult salmon for a DNA analysis that will be conducted by the U.S. Fish and Wildlife Service (USFWS) genetics laboratory in Anchorage. USFWS personnel will summarize these analyses in a separate report. The sampling goal for this genetics study was to obtain one fin clip from as many Chinook salmon as possible. All fin clip samples were collected, preserved, and shipped according to procedures outlined by the Blaine Flannery of the USFWS genetics lab in Anchorage (Eryn Kahler, ADF&G Nulato weir crew leader, personal communication).

Hydrological and Climatological Sampling

Climatological and hydrological data were collected at approximately 1800 hours each day at the campsite. Relative stream depth was monitored on a staff gauge marked in 0.1-ft increments with measurements subsequently converted to cm. Water temperature was measured in Celsius (°C) near shore at a depth of about 0.5 m. Subjective notes describing wind speed, cloud cover, and precipitation were recorded by the crew leader.

RESULTS AND DISCUSSION

Escapement Estimation

A resistance board weir was operated on the Nulato River from July 5 to July 22 in 2003. High water levels on the Nulato River prevented the installation of the weir prior to June 29 and operation of the weir prior to July 5.

The final Nulato River weir counts for 2003 were: 1,997 chinook salmon and 19,590 summer chum salmon (Table 1). An estimated 5 percent of the chinook salmon counted were jacks (Age 1.1). The unadjusted 2003 weir counts were: 1,762 chinook salmon and 17,765 summer chum salmon (Appendix A.1- A.3)

Chinook and summer chum salmon were both observed daily at Nulato weir throughout 2003. The daily peak count of 314 chinook salmon occurred on July 6; a second peak of 212 chinook salmon occurred on July 19. The peak daily count of 1,817 summer chum salmon occurred on July 7; subsequent peaks of 1,430 summer chum passed on July 13 and 1,703 summer chum on July 18.

Challenges with high water conditions, debris, personnel, and breaching problems with the weir affected the reliability of the reported salmon passage estimates (Figure 4). One or more counts were missed on the following dates: July 8 (n=2), July 11 (n=1), July 14 (n=1), July 16 (n=1), July 18 (n=1), July 20 (n=1), July 21 (n=2), and July 22 (n=1). One or more counts were affected by breaches in the weir on the following dates: July 13 (n=3), July 14 (n=1), July 17 (n=2), July 19 (n=1), and July 20 (n=1).

Chinook Salmon

The chinook salmon escapement estimate for the Nulato River was 1,997 (Table 1). Figure 5 illustrates the relative passage estimate by day. Detailed passage by scheduled counting times and date can be found in Appendix A.

The first quartile date of passage occurred on July 8 (Table 1), which equals the median first quartile date observed since 1994 (Table 2, Figure 6). The median day occurred on July 14, three days later than the 9-year average (1994-2000 and 2002) of July 11. The last quartile occurred on July 19, four days later than the 9-year average of July 15.

Historical chinook salmon run timing at Nulato River by year can be found in Appendix B.1. The total estimated chinook salmon escapement in 2003 was equal to the 1994-2002 year mean. Sandone (1995) reported that chinook salmon typically travel in the deepest part of the channel or near the middle of the river, where many were probably not seen or counted from the counting tower. Therefore, the tower escapement estimate of chinook salmon was considered a

conservative estimate and below the actual escapement.

Chinook salmon exhibited a diurnal migratory behavior in 2003. Chinook salmon generally migrated upriver with the highest passage typically occurring between 1500 and 2100 hours and the lowest passage occurring between 0700 and 1100 hours (Figure 7).

Due to heavy rains and high water conditions, no aerial surveys were flown on the Nulato River in 2003. However, the total 2003 weir estimate for chinook salmon was above the aerial escapement objective of 1,300 chinook salmon for the North Fork and South Fork Nulato River combined.

No fin clip samples were collected from chinook salmon at Nulato River weir in 2003. The passage chute / trap in the weir was not an effective means of capturing chinook salmon because they would not enter the trap when the gate was closed and were easily spooked when approaching or passing through the chute.

Summer Chum Salmon

The summer chum salmon escapement estimate for the Nulato River was 19,590 (Table 1). Figure 5 illustrates the relative passage estimate by day. Detailed passage by scheduled counting times and date can be found in Appendix A.

The first quartile day of passage occurred on July 8, five days later than the 8-year average (1994-2002) of July 3 (Table 3, Figure 6). The median day occurred on July 13, six days later than the 8-year average of July 7, and the last quartile occurred on July 18, six days later than the 8-year average of July 12.

The historical daily and cumulative summer chum salmon escapement passage estimates for Nulato River are presented in Appendix B.2. The 2003 summer chum escapement estimate well below the 1994-2002 mean of 107,180 salmon (Table 3, Figure 6).

Passage of summer chum salmon in the Nulato River in 2003 exhibited a diurnal pattern. Figure 7 illustrates scheduled hourly counts increasing in the afternoon, peaking at 2100 hours, fewer counts at 0700 hours, and the lowest counts occurred at 1100 hours. Detailed passage by date, hour and bank can be found in Appendix A.

No aerial surveys were flown on the Nulato River in 2003 because of heavy rains and high water conditions. However, there are currently no aerial escapement goals or ranges established for summer chum salmon in the Nulato River drainage.

Fin clip samples were collected from about 100 summer chum salmon at the Nulato River weir for DNA analysis that will be preformed and reported by the USFWS genetics laboratory in Anchorage.

Age-Sex-Length

In 2003, 377 summer chum salmon were capture in the passage chute / trap at the Nulato River weir and sampled for age, sex, and length (Appendix C.1). The samples were combined into three strata for analysis, each representing one third of the run.

Most of the summer chums were age-0.3 (79.5 %) and age-0.4 (17.6%) fish, with lesser numbers of age-0.2 (1.7%) and age-0.5 (1.2%) fish (Table 4, Appendix C.1).

The weighted sex ratio was 58.2% males and 41.8% females.

Mean lengths ranged from 568 mm to 647 mm for males and 521 mm to 550 mm for females (Appendix C.1).

A breakdown of the Nulato River summer chum ASL samples by sex, age, and sampling strata is presented in Figure 8. The sex composition by sampling strata shows that males predominated in all samples, but the percent of females increased throughout the season. In the age composition by strata graph, age-0.3 fish predominated in all three sampling strata and age-0.4 fish were the second most numerous age class. The final graphic of sex composition by age shows that males were also dominant in all of the major age classes.

Too few chinook salmon were caught in the passage chute / trap of the weir to analyze age and sex composition of the chinook run. Because of the chinook salmons reluctance to enter the passage chute / trap, this was not an effective method for catching chinook salmon for ASL sampling at Nulato River. No carcass-sampling project was conducted on the Nulato River, therefore no escapement age and sex information is available for chinook salmon.

Hydrology and Climate

For most tributaries of the Yukon River, the water is usually highest during or shortly after breakup, and generally continues to drop during the summer as the snow pack decreases. Storage capacity of the Nulato River watershed appears to be minimal, with limited retention of rainfall in the upper areas of the drainage. The Nulato River, similar to the Anvik River, has rapid changes in water depth when substantial rainfall occurs. These flood conditions make counting difficult or impossible because of the suspended solids, detritus, tannic staining, and increased water depth. High water and a heavy debris load made it very difficult to operate and maintain a weir at this site in 2003.

Intermittent to heavy rainfall was observed on 14 out of 29 recorded weather days, with 15 days recording no rainfall (Table 5). The highest water level was recorded on July 3 and the lowest water level was recorded on June 23 (Table 5, Figure 9). Water temperatures ranged from 6°C to 14°C. No air temperature data was recorded. Water clarity varied from clear to brown, but was predominantly light brown.

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TABLES

FIGURES

APPENDICES

Table 1. Final daily and cumulative counts for chinook and summer chum salmon and the daily and cumulative proportions at Nulato River weir, 2003.

Date	[a]	Chinook Salmon						Summer Chum Salmon			
		Final Counts				Proportions		Final Counts		Proportions	
		Adults	Jacks	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
25-Jun											
26-Jun											
27-Jun											
28-Jun											
29-Jun	[b]										
30-Jun	[b]										
1-Jul	[b]										
2-Jul	[c]										
3-Jul	[d]										
4-Jul	[d]										
5-Jul	[e]	36	-	36	36	0.018	0.018	685	685	0.035	0.035
6-Jul	[f]	314	-	314	350	0.157	0.175	1,519	2,204	0.078	0.112
7-Jul		134	10	144	494	0.072	0.247	1,817	4,021	0.093	0.205
8-Jul	[f]	72	14	86	580	0.043	0.290	1,476	5,496	0.075	0.281
9-Jul		117	6	123	703	0.062	0.352	1,385	6,881	0.071	0.351
10-Jul		51	3	54	757	0.027	0.379	745	7,626	0.038	0.389
11-Jul	[f]	34	3	36	793	0.018	0.397	656	8,282	0.033	0.423
12-Jul		97	7	104	897	0.052	0.449	1,221	9,503	0.062	0.485
13-Jul		80	6	86	983	0.043	0.492	1,430	10,933	0.073	0.558
14-Jul	[f]	72	2	73	1,056	0.037	0.529	1,202	12,135	0.061	0.619
15-Jul		58	0	58	1,114	0.029	0.558	800	12,935	0.041	0.660
16-Jul	[f]	64	0	64	1,178	0.032	0.590	229	13,164	0.012	0.672
17-Jul		99	7	106	1,284	0.053	0.643	746	13,910	0.038	0.710
18-Jul	[f]	123	14	137	1,421	0.068	0.711	1,703	15,613	0.087	0.797
19-Jul		195	17	212	1,633	0.106	0.817	1,495	17,108	0.076	0.873
20-Jul	[f]	195	14	209	1,842	0.105	0.922	1,165	18,273	0.059	0.933
21-Jul	[f]	137	5	142	1,983	0.071	0.993	1,005	19,278	0.051	0.984
22-Jul	[g]	14	0	14	1,997	0.007	1.000	312	19,590	0.016	1.000
23-Jul											
24-Jul											

[a] June 16-22, 2003 - set up camp

[b] Constructed and installed a resistence board weir: (6/29) installed 22 panels; (6/30) trap installed and weir 3/5 complete; (7/01) installation complete, weir fish tight by 2000 hours.

[c] Water level up 1.5 feet, several panels down, and water flowing over the top of the trap. Weir not fish tight, unable to count.

[d] A large tree (50 ft long with a substantial root ball) floated downsteam and washed up against the weir. It submerged 3 panels and blocked the boat gate and the trap. Weir not fish tight, unable to count.

[e] Tree cleared out of the way; water level dropping; weir repaired, fish tight, and operational by evening. First 30-minute salmon counts made at 2100 hours July 5, 2003.

[f] One or more interpolated counts for the following dates and times: (7/06) 1100 hours; (7/08) 1100 and 1530 hours; (7/11) 1530 hours; (7/14) 1530 hours; (7/16) 1100 hours; (7/18) 1530 hours; (7/20) 1530 hours; (7/21) 0700 and 1100 hours

[g] Last 30-minute salmon count made at 1800 hours July 22, 2003. Unable to interpolate a count for (7/22) 2100 hours.

Table 2. Annual Nulato River passage estimates and associated passage-timing statistics for chinook salmon escapements, 1994-2003.

	Year	Passage Estimate [a]	Day of First Salmon Counts	First Quartile Day	Median Day	Third Quartile Day	First Count & First Quartile	Days Between Quartiles: First & Median	Median & Third	First & Third
	1994	1,795	5-Jul	11-Jul	14-Jul	19-Jul	6	3	5	8
	1995	1,412	26-Jun	11-Jul	16-Jul	20-Jul	15	5	4	9
	1996	756	26-Jun	7-Jul	11-Jul	15-Jul	11	4	4	8
	1997	4,811	23-Jun	4-Jul	8-Jul	13-Jul	11	4	5	9
	1998	1,504	24-Jun	10-Jul	14-Jul	17-Jul	16	4	3	7
	1999	1,932	3-Jul	10-Jul	14-Jul	19-Jul	7	4	5	9
	2000	916	28-Jun	5-Jul	7-Jul	10-Jul	7	2	3	5
[b]	2001									
	2002	2,696	25-Jun	5-Jul	9-Jul	13-Jul	10	4	4	8
	2003	1,997	5-Jul	8-Jul	14-Jul	19-Jul	2	7	5	12
[c]	Mean	1,978	27-Jun	7-Jul	11-Jul	15-Jul	10.4	3.8	4.1	7.9
[c]	Median	1,650	26-Jun	8-Jul	12-Jul	16-Jul	10.5	4.0	4.0	8.0
[c]	SE	1,295	4.3	2.9	3.3	3.6	3.7	0.9	0.8	1.4

[a] Passage estimate methods - 1994-2002 from counting towers, 2003 from a resistence board weir.

[b] Because of high water throughout the season, only four days of counting occurred. No expansions were calculated.

[c] Mean, Median and Standard Errors (SE) do not include the current year so that historical comparisons are plausible.

Table 3. Annual Nulato River passage estimates and associated passage-timing statistics for summer chum salmon escapements, 1994-2003.

	Year	Passage Estimate [a]	Day of First Salmon Counts	First Quartile Day	Median Day	Third Quartile Day	First Count & First Quartile	Days Between Quartiles: First & Median	Median & Third	First & Third
	1994	148,762	29-Jun	4-Jul	9-Jul	13-Jul	5	5	4	9
	1995	236,890	21-Jun	2-Jul	7-Jul	11-Jul	11	5	4	9
	1996	129,694	21-Jun	27-Jun	3-Jul	8-Jul	6	6	5	11
	1997	158,171	20-Jun	30-Jun	5-Jul	8-Jul	10	5	3	8
	1998	52,041	22-Jun	7-Jul	12-Jul	15-Jul	15	5	3	8
	1999	30,076	24-Jun	7-Jul	11-Jul	16-Jul	13	4	5	9
	2000	29,366	24-Jun	5-Jul	9-Jul	14-Jul	11	4	5	9
[c]	2001									
	2002	72,230	23-Jun	2-Jul	6-Jul	11-Jul	9	4	5	9
	2003	19,590	5-Jul	8-Jul	13-Jul	18-Jul	3	5	5	10
[c]	Mean	107,154	23-Jun	3-Jul	7-Jul	12-Jul	10.0	4.8	4.3	9.0
[c]	Median	100,962	22-Jun	3-Jul	8-Jul	12-Jul	10.5	5.0	4.5	9.0
[c]	SE	73,604	2.8	3.5	3.1	3.0	3.3	0.7	0.9	0.9

[a] Passage estimate methods - 1994-2002 from counting towers, 2003 from a resistence board weir.

[b] Because of high water throughout the season, only four days of counting occurred. No expansions were calculated.

[c] Mean, Median and Standard Errors (SE) do not include the current year so that historical comparisons are plausible.

Table 4a. Nulato River summer chum salmon weighted age and sex composition and mean length, 2003.

		Brood Year and Age Group				
		2000	1999	1998	1997	
		0.2	0.3	0.4	0.5	Total
Male	No. in Sample	0	170	45	3	218
	Percent of Sample	0.0	44.9	12.4	0.9	58.2
	Mean Length (mm)		568.0	609.0	647.0	
	Std. Deviation		2.0	5.0	13.0	
Female	No. in Sample	6	131	21	1	159
	Percent of Sample	1.7	34.6	5.2	0.3	41.8
	Mean Length (mm)	521.0	539.0	569.0	550.0	
	Std. Deviation	3.0	2.0	5.0		
Total	No. in Sample	6	301	66	4	377
	Percent of Sample	1.7	79.5	17.6	1.2	100.0

Table 5. Nulato River weir project climatological and hydrological observations, 2003.

Date	Time (hh:mm)	Precipitation[a]	Wind (Direction and Velocity)	Sky[b]	Temperature (°C) Air	Temperature (°C) Water	Water Gauge (cm)	Water Color[c]	Remarks
16-Jun[d]	-	-	-	-	-		-	Br	June 16-22 camp setup, unable to begin operating the weir due high water
17-Jun	-	-	-	-	-		-	Br	In communication with Project Leader, Eryn Kahler, twice daily during this period.
18-Jun	-	-	-	-	-		-	Br	
19-Jun	-	-	-	-	-		137	Lt	
20-Jun	-	-	-	-	-		130	Lt	
21-Jun	-	-	-	-	-		127	Lt	
22-Jun	-	-	-	-	-		94	Lt	
23-Jun	17:00	T	S 10	4	-		91	Lt	Eryn Kahler arrived at Nulato
24-Jun	18:00	T	S 05	2	-		137	Br	
25-Jun	18:00	0	0	1	-		152	Br	Rain last night, water level up ~6 inches, brown water.
26-Jun	18:00	0	0	1	-		132	Br	
27-Jun	18:00	0	0	3	-		124	Lt	
28-Jun[e]	18:00	1	na 3	4	-		114	Lt	
29-Jun	18:00	R	na 5	4	-		112	Lt	
30-Jun	18:00	R	na 7	4	-		112	Cl	
01-Jul	18:00	R	na 8	4	-		112	Cl	
02-Jul	18:00	R	na 5	4	-	6	160	Br	Water level up 1.5 feet since yesterday.
03-Jul	18:00	R	na 2	4	-	7	168	Br	
04-Jul	18:00	R	na 2	3	-	9	157	Br	
05-Jul	18:00	0	na 10	2	-		152	Lt	Began operating the weir at 1600 hours on July 5, 2003. Lost the thermometer
06-Jul	18:00	0	na 15	1	-		145	Lt	
07-Jul	18:00	0	na 15	1	-	9	145	Cl	Found the water thermometer
08-Jul	18:00	0	na 15	2	-	12	142	Br	
09-Jul	18:00	0	na 10	3	-	13	140	Br	Water level still high, dropping slowly, still brown.
10-Jul	18:00	0	na 5	4	-	10	135	Lt	
11-Jul	18:00	0	na 0	3	-	9	132	Lt	
12-Jul	18:00	I	na 25	2	-	9	114	Lt	
13-Jul	19:15	R	na 8	4	-	9	114	Lt	Very windy, blew the A-frame off the cook tent several times.
14-Jul	18:00	R	na 10	4	-	7	119	Lt	Pouring rain since 2200 hours July 13
15-Jul	18:00	I	na 5	4	-	6	122	Lt	
16-Jul	21:00	0	na 5	1	-	9	117	Cl	
17-Jul	18:00	0	na 2	1	-	10	114	Cl	
18-Jul	19:15	0	na 10	1	-	14	114	Cl	
19-Jul	19:15	0	na 10	1	-	14	112	Cl	
20-Jul	18:00	0	na 10	1	-	12	112	Lt	
21-Jul	18:00	I	na 3	4	-	11	112	Lt	
22-Jul	-	-	-	-	-		-	-	Last day weir was operated

[a] Precipitation Codes: 0 = no precipitation, I = intermittent rain, R = continuous rain, T = thunder shower

[b] Sky Codes: 0 = no observation made, 1 = clear sky, cloud cover less than or equal to 10%, 2 = cloud cover less than or equal to 50%, 3 = cloud cover greater than 50%, 4 = completely overcast, 5 = fog, thick haze, or smoke

[c] Water Color Codes: Cl = clear, Lt = light brown, Br = brown

[d] - = no data, no measurement made

[e] na = not available, no wind direction

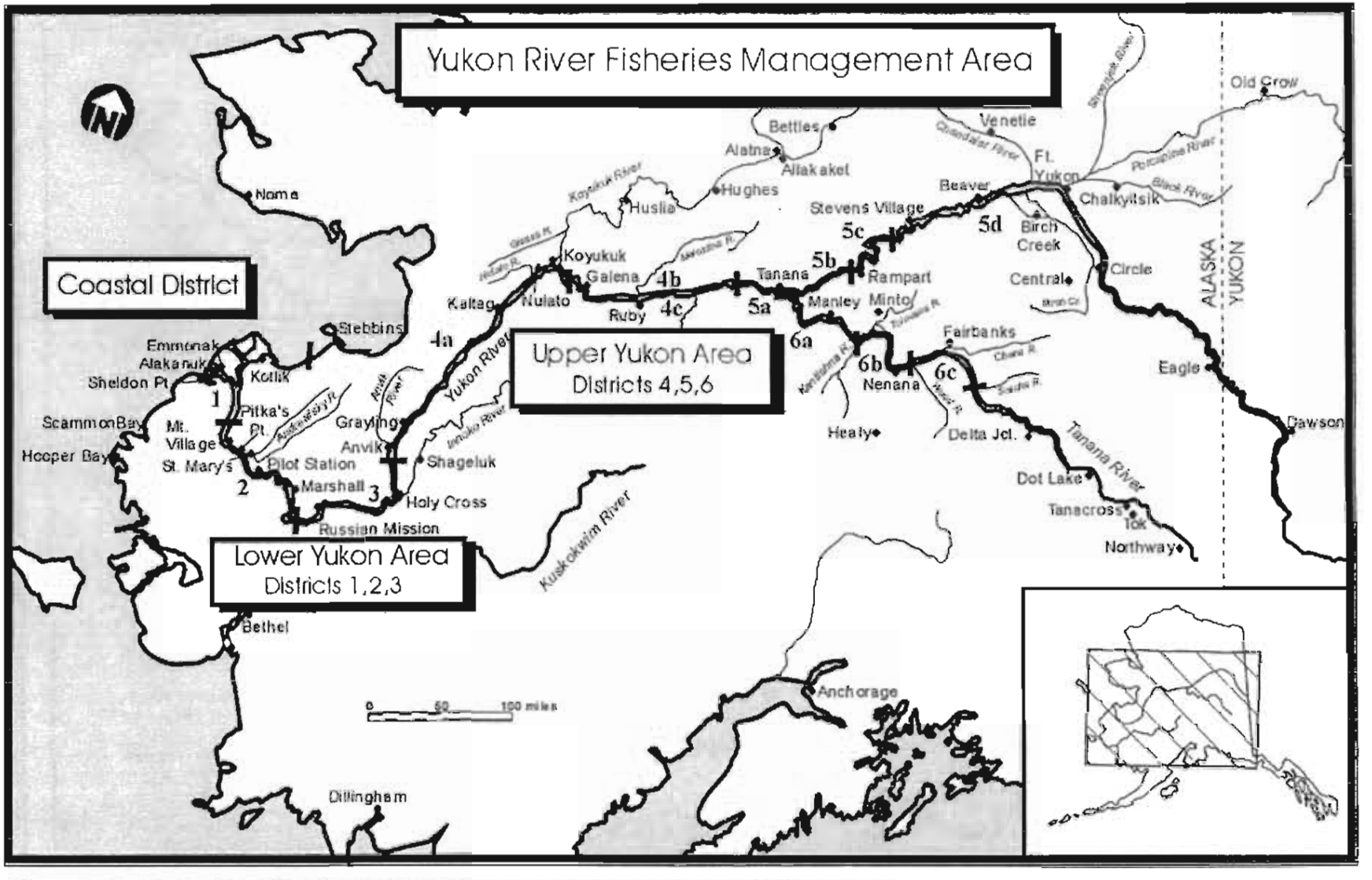


Figure 1. Alaska portion of the Yukon River showing villages and fishing district boundaries.

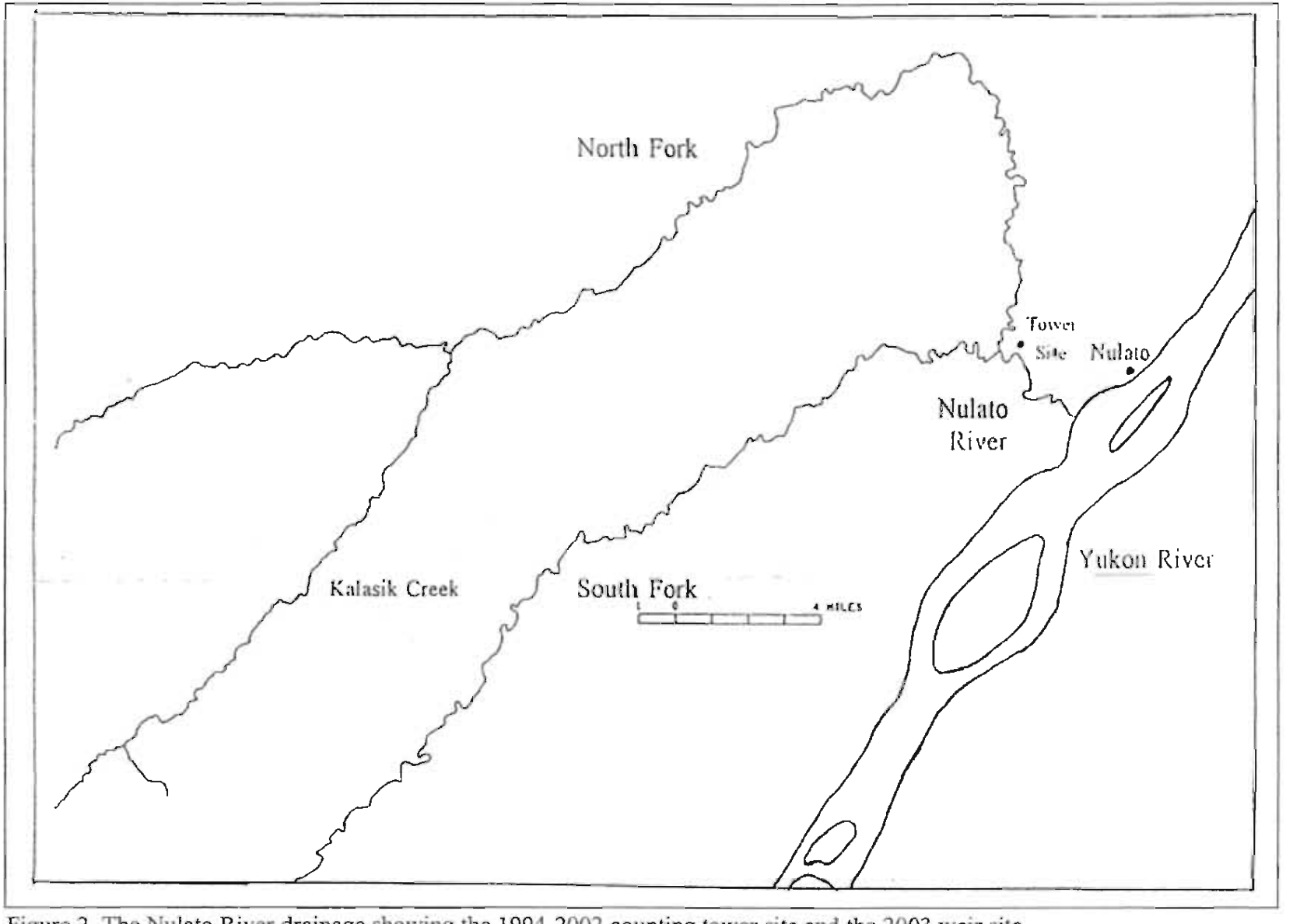


Figure 2. The Nulato River drainage showing the 1994-2002 counting tower site and the 2003 weir site.

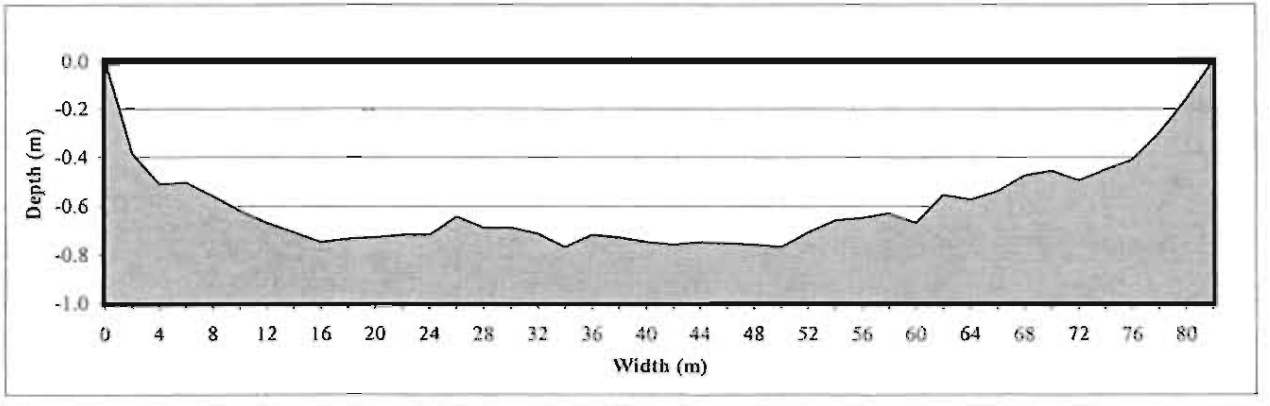
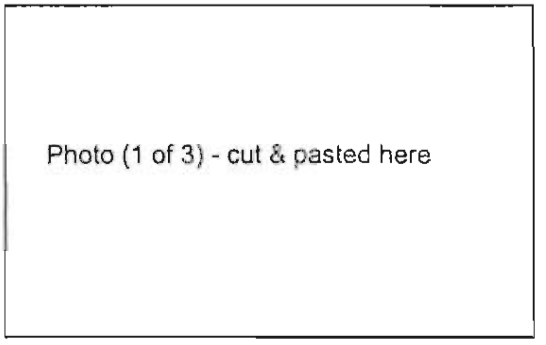
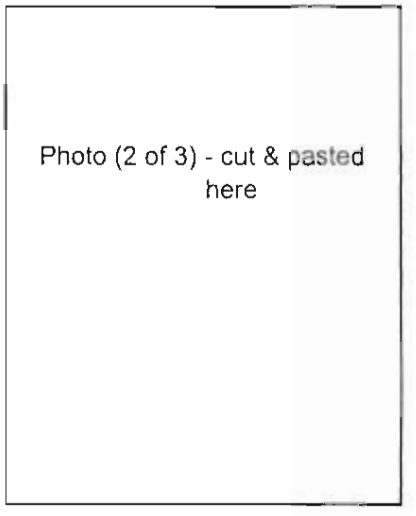


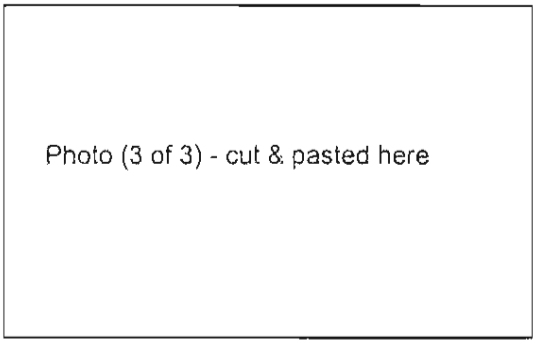
Figure 3. River bottom profiles at the Nulato River weir site, 2003.



(a) High water flowed over the passage chute/ trap and the weir on July 2, 2003.

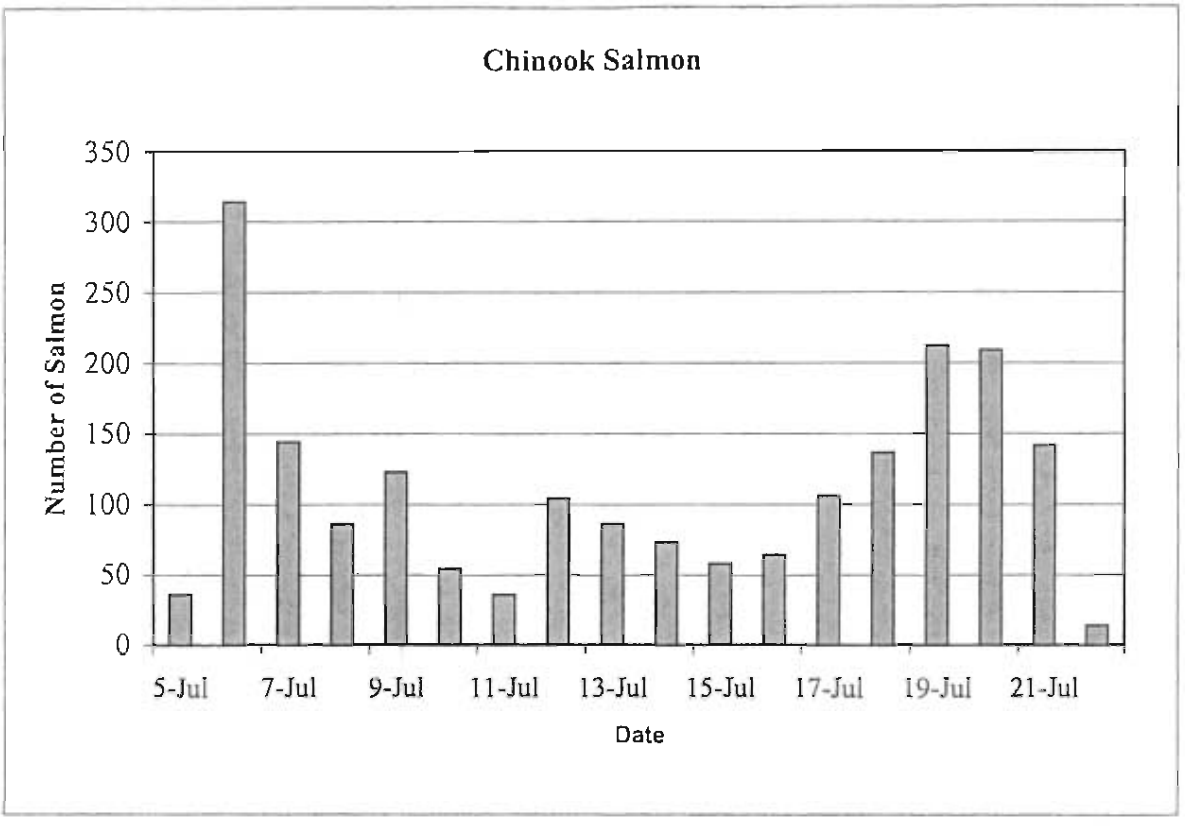


(b) Heavy accumulation fo debris had to be cleared from the weir up to three times per day.



(c) A large tree brearched the weir on July 3, 2003. It submerged three weir panels, blocked the boat gate, and blocked the passage chute / trap.

Figure 4. Several factors which affected the rellability of the salmon estimates at Nulato River weir, 2003. All photos by Eric Barnhill (BSFA).



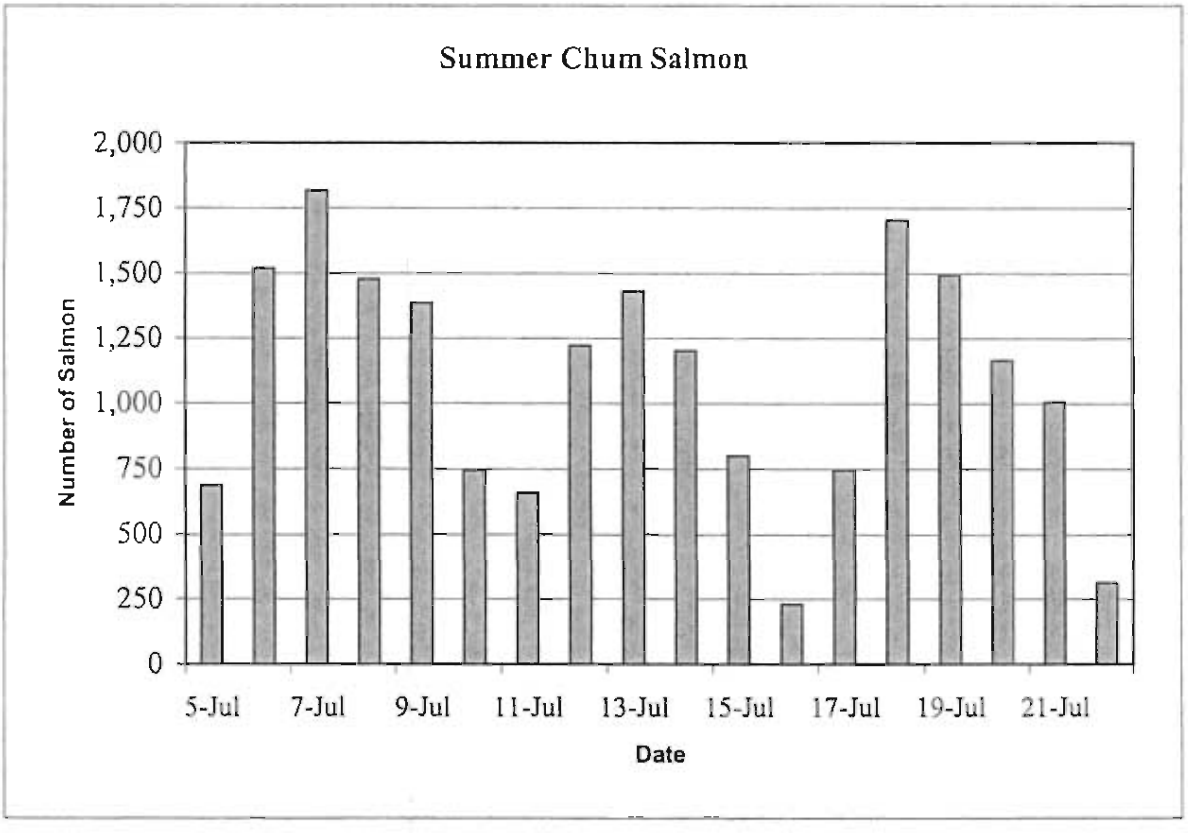
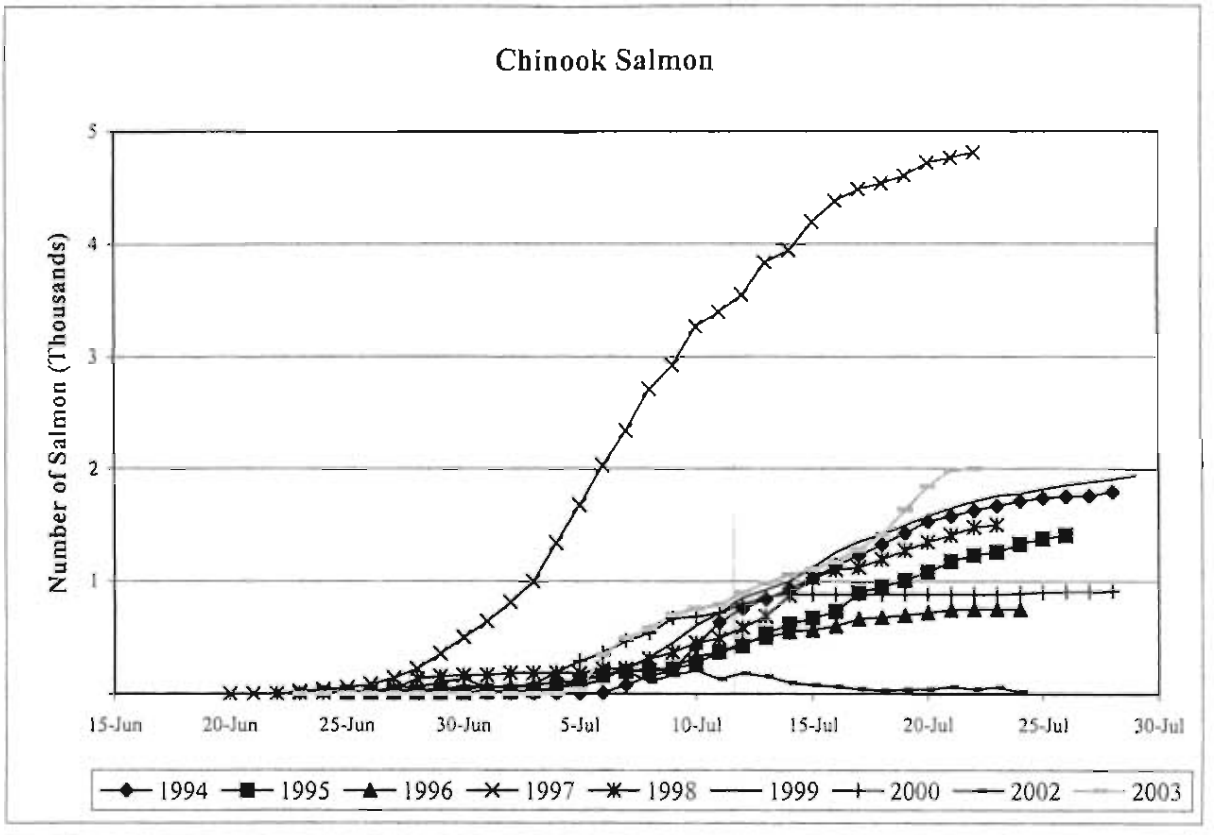


Figure 5. Nulato River chinook and summer chum salmon estimated daily counts, 2003.



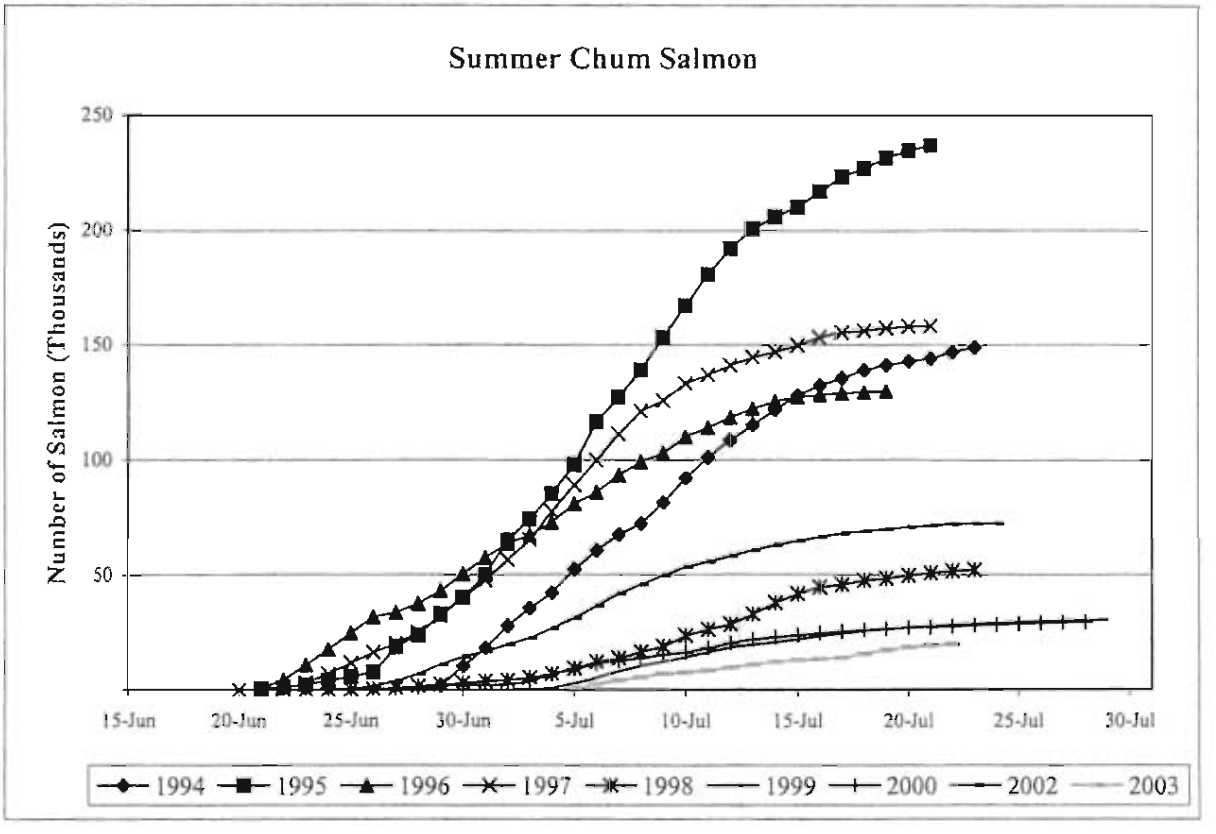


Figure 6. Nulato River chinook and summer chum salmon cumulative counts, 1994-2003.

Table 4. Season total counts and proportions by hour for Nulato River chinook and summer chum salmon, 2002.
Fig 7 worksheet

Hour Ending	Chinook Salmon		Summer Chum Salmon	
	Counts	Proportions	Counts	Proportions
1:00	0	0.000	0	0.000
2:00	0	0.000	0	0.000
3:00	0	0.000	0	0.000
4:00	0	0.000	0	0.000
5:00	0	0.000	0	0.000
6:00	0	0.000	0	0.000
7:00	46	0.023	3,428	0.175
8:00	0	0.000	0	0.000
9:00	0	0.000	0	0.000
10:00	0	0.000	0	0.000
11:00	65	0.033	1,579	0.081
12:00	0	0.000	0	0.000
13:00	0	0.000	0	0.000
14:00	0	0.000	0	0.000
15:00	659	0.330	3,630	0.185
16:00	0	0.000	0	0.000
17:00	0	0.000	0	0.000
18:00	700	0.351	4,467	0.228
19:00	0	0.000	0	0.000
20:00	0	0.000	0	0.000
21:00	527	0.264	6,487	0.331
22:00	0	0.000	0	0.000
23:00	0	0.000	0	0.000
24:00	0	0.000	0	0.000
Total	1,997	1.000	19,590	1.000

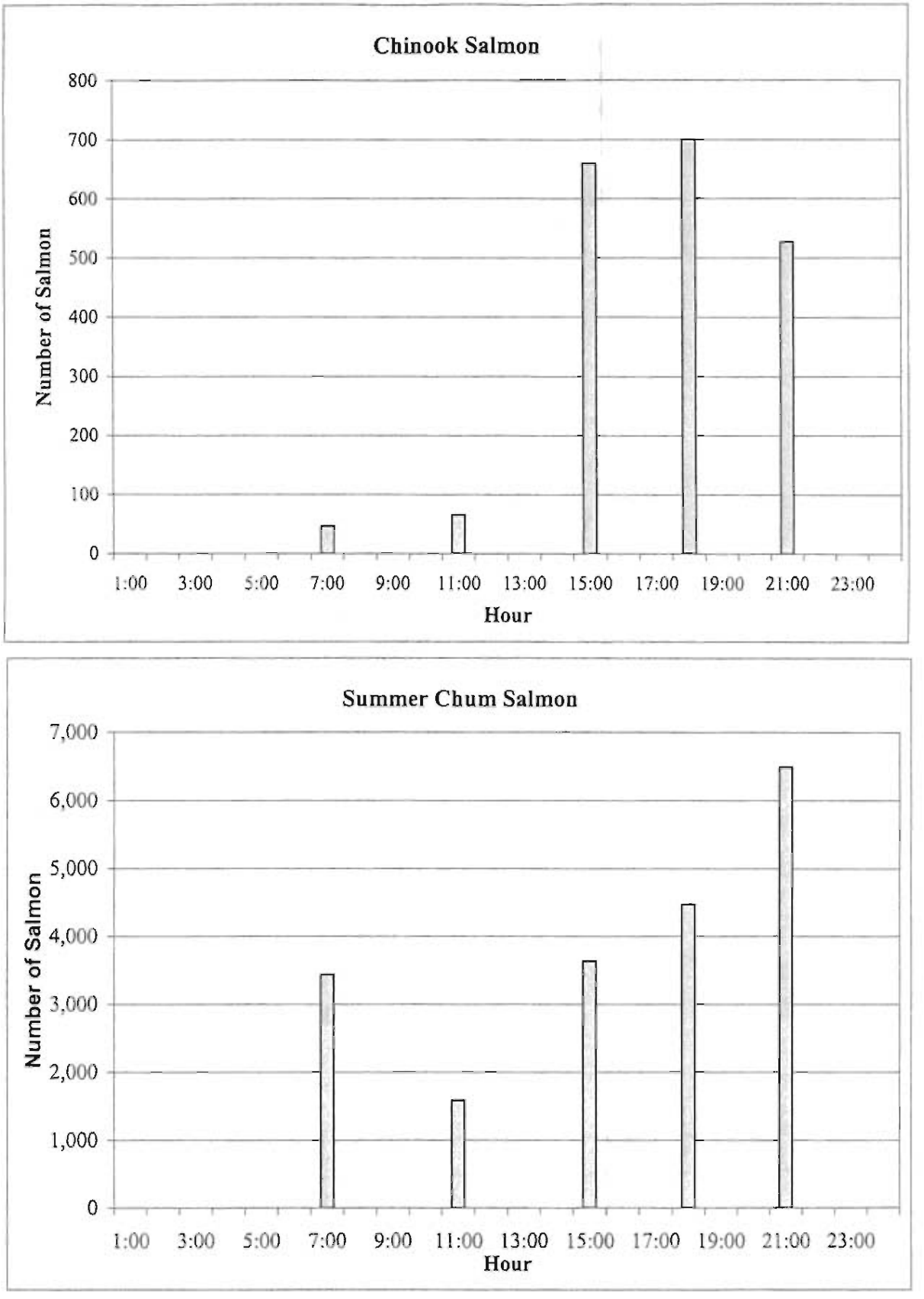
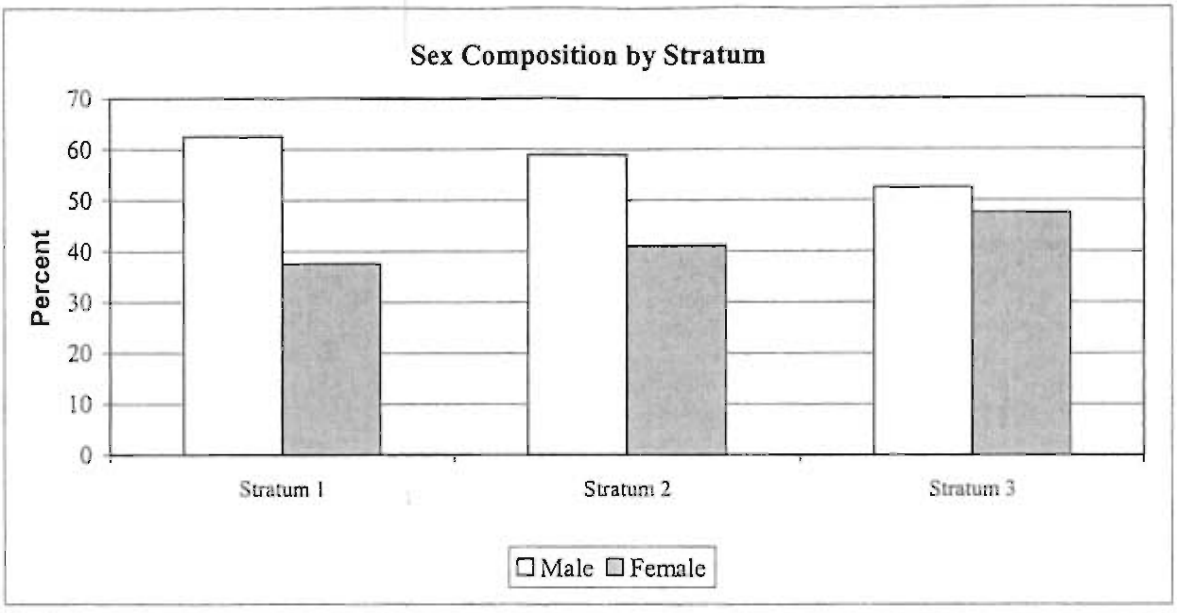
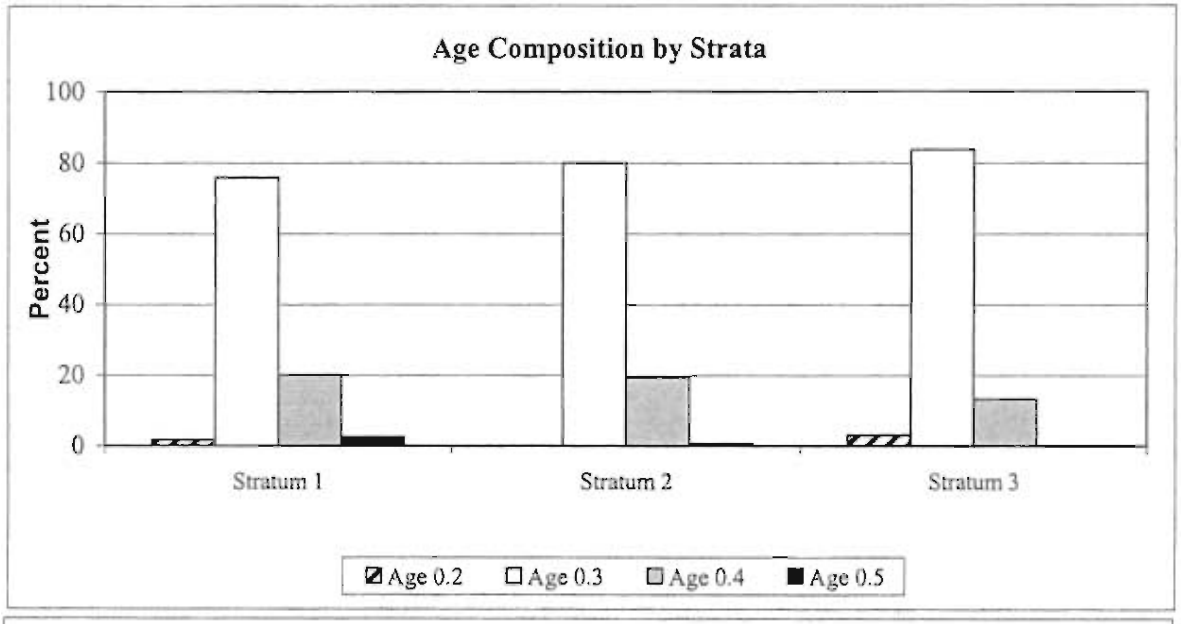


Figure 7. Nulato River chinook and summer chum salmon total estimated counts by hour, July 5 through July 22, 2003.





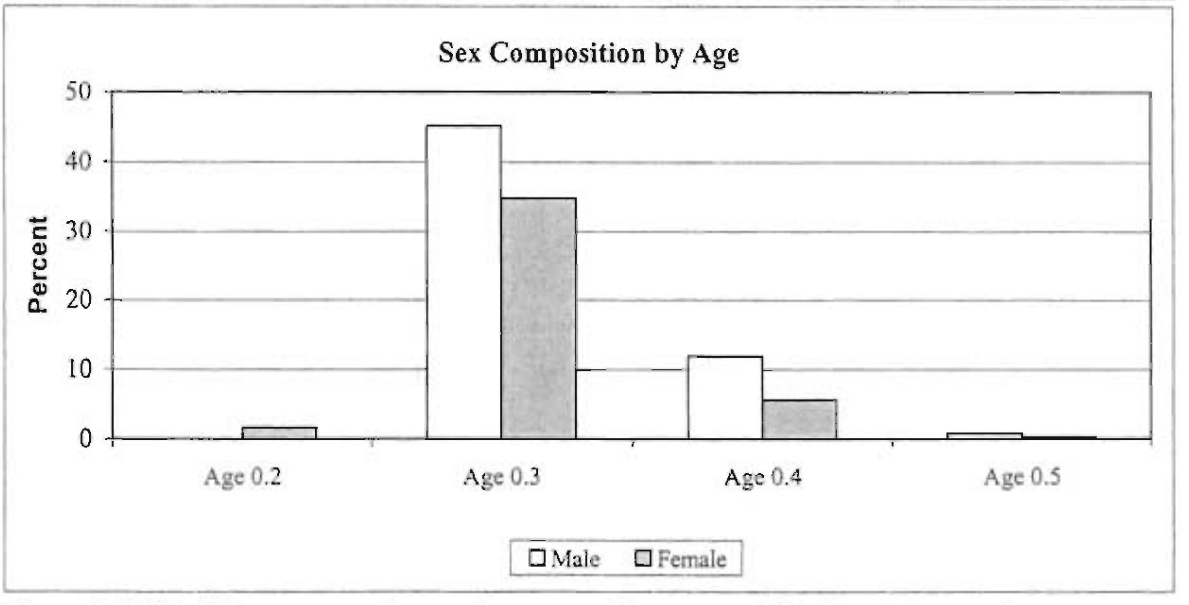
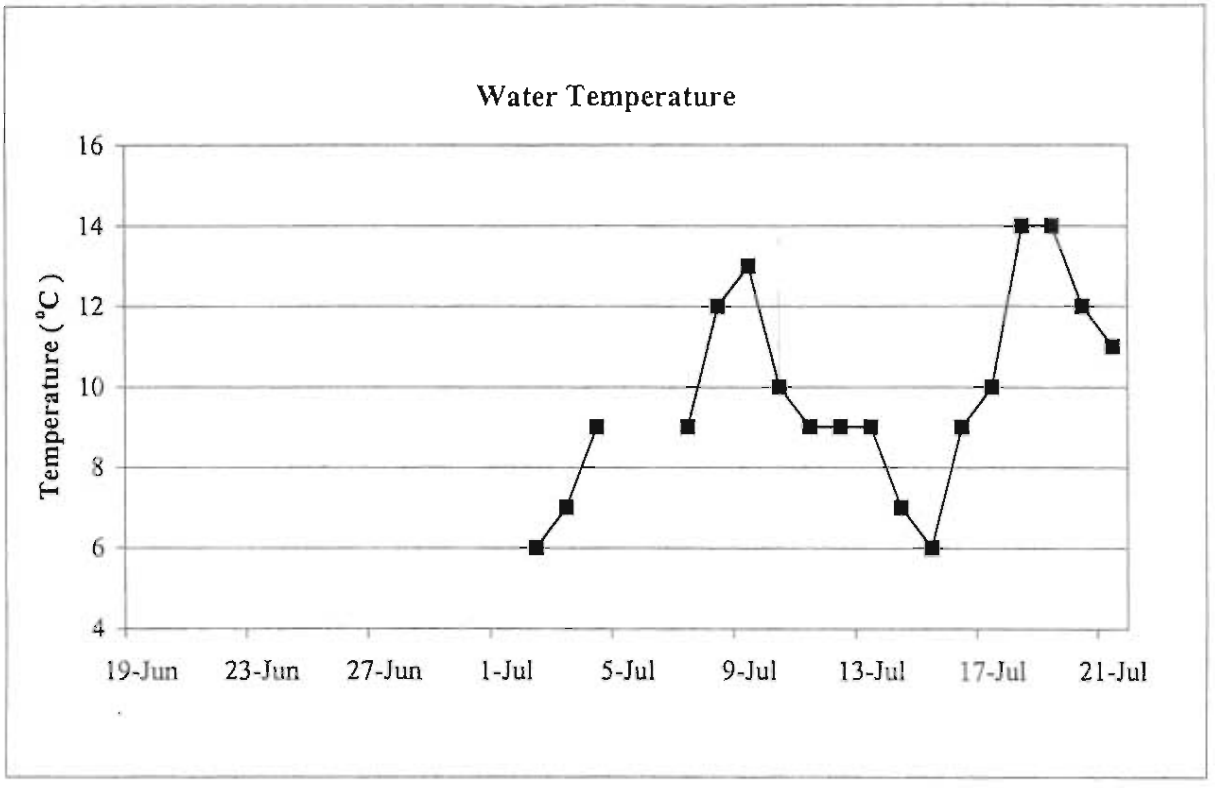


Figure 8. Nulato River summer chum salmon age and sex composition by stratum, and sex composition by age group, 2003.



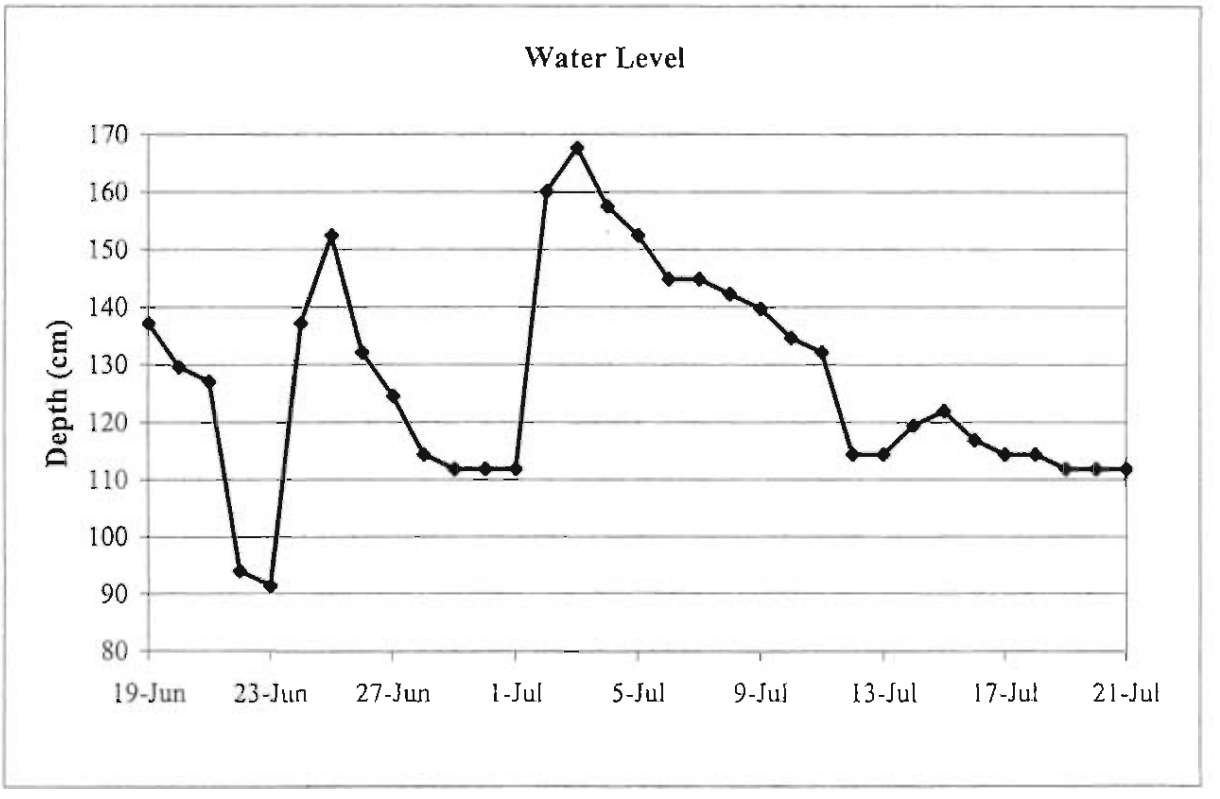
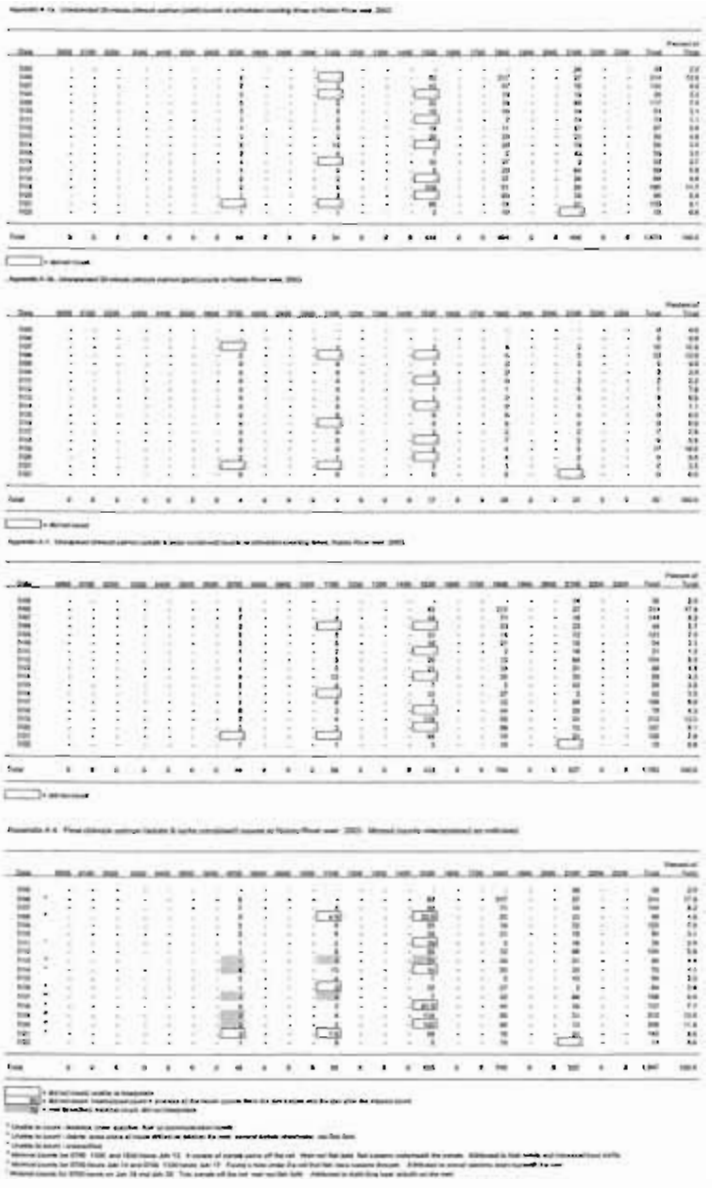


Figure 9. Nulato River weir escapement project hydrological observations, 2003.



Appendix A.2. Unadjusted chinook salmon (jacks) counts at scheduled counting times, Nulato River weir, 2003.

Date		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1530	1600	1700	1800	1900	2000	2100	2200	2300	Total	Percent of Total
7/06	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/06	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/07		-	-	-	-	-	-	-	[-]	-	-	-	1	-	-	-	2	-	-	4	-	-	3	-	-	10	10.9
7/08		-	-	-	-	-	-	-	2	-	-	-	[-]	-	-	-	[-]	-	-	5	-	-	5	-	-	12	13.0
7/09		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	1	-	-	2	-	-	3	-	-	6	6.5
7/10		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	2	-	-	1	-	-	3	3.3
7/11		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	[-]	-	-	0	-	-	2	-	-	2	2.2
7/12		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	1	-	-	1	-	-	5	-	-	7	7.6
7/13		-	-	-	-	-	-	-	0	-	-	-	2	-	-	-	1	-	-	3	-	-	0	-	-	6	6.5
7/14		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	[-]	-	-	0	-	-	1	-	-	1	1.1
7/15		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	0	-	-	0	-	-	0	0.0
7/16		-	-	-	-	-	-	-	0	-	-	-	[-]	-	-	-	0	-	-	0	-	-	0	-	-	0	0.0
7/17		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	2	-	-	3	-	-	2	-	-	7	7.6
7/18		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	[-]	-	-	7	-	-	2	-	-	9	9.8
7/19		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	8	-	-	4	-	-	5	-	-	17	18.5
7/20		-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	[-]	-	-	4	-	-	2	-	-	9	9.8
7/21		-	-	-	-	-	-	-	[-]	-	-	-	[-]	-	-	-	2	-	-	1	-	-	0	-	-	3	3.3
7/22		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	0	-	-	[-]	-	-	0	0.0
Total		0	0	0	0	0	0	0	4	0	0	0	4	0	0	0	17	0	0	36	0	0	31	0	0	92	100.0

[ ] = did not count

* Did not count jacks prior to 1100 hours on July 7

Appendix A.5. Final chinook salmon (jacks) counts at Nulato River weir, 2003. Missed counts interpolated as indicated.

Date		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1530	1600	1700	1800	1900	2000	2100	2200	2300	Total	Percent of Total
7/05	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/06	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/07		-	-	-	-	-	-	-	[-]	-	-	-	1	-	-	-	2	-	-	4	-	-	3	-	-	10	9.4
7/08		-	-	-	-	-	-	-	2	-	-	-	[0.5]	-	-	-	[1.5]	-	-	5	-	-	5	-	-	14	13.1
7/09		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	1	-	-	2	-	-	3	-	-	6	5.6
7/10		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	2	-	-	1	-	-	3	2.8
7/11	*	-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	[0.5]	-	-	0	-	-	2	-	-	3	2.8
7/12		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	1	-	-	1	-	-	5	-	-	7	6.6
7/13	*	-	-	-	-	-	-	-	[0]	-	-	-	[2]	-	-	-	[1]	-	-	3	-	-	0	-	-	6	5.6
7/14	*	-	-	-	-	-	-	-	[0]	-	-	-	0	-	-	-	[0.5]	-	-	0	-	-	1	-	-	2	1.4
7/15		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	0	-	-	0	-	-	0	0.0
7/16	*	-	-	-	-	-	-	-	0	-	-	-	[0]	-	-	-	0	-	-	0	-	-	0	-	-	0	0.0
7/17	*	-	-	-	-	-	-	-	[0]	-	-	-	[0]	-	-	-	2	-	-	3	-	-	2	-	-	7	6.6
7/18	*	-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	[0.5]	-	-	7	-	-	2	-	-	14	13.1
7/19	*	-	-	-	-	-	-	-	[2]	-	-	-	0	-	-	-	8	-	-	4	-	-	5	-	-	17	16.0
7/20	*	-	-	-	-	-	-	-	[2]	-	-	-	1	-	-	-	[0]	-	-	4	-	-	2	-	-	14	13.1
7/21	*	-	-	-	-	-	-	-	[1]	-	-	-	[0.5]	-	-	-	2	-	-	1	-	-	0	-	-	5	4.2
7/22		-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	0	-	-	[-]	-	-	0	0.0
Total		0	0	0	0	0	0	0	5	0	0	0	5	0	0	0	30	0	0	36	0	0	31	0	0	107	100.0

[ ] = did not count; unable to interpolate
[10] = did not count, interpolated count = average of the hourly counts from the day before and the day after the missed count
2 = weir breached, minimal count, did not interpolate

* Unable to count - logistics; crew, supplies, fuel, or communication needs
* Unable to count - debris; large piece of moss drifted up against the weir, several panels underwater, not fish tight
* Unable to count - unspecified
* Minimal counts for 0700, 1100, and 1530 hours July 13. A couple of panels came off the rail. Weir not fish tight, fish passing underneath the panels. Attributed to high winds and increased boat traffic.
* Minimal counts for [illegible] hours July 14 and 0700, 1100 hours July 17. Found a hole under the rail that fish were passing through. Attributed to gravel washing away underneath the weir.
* Minimal count [illegible] ours on July 19 and July 20. Two panels off the rail, weir not fish tight. Attributed to night time boat activity on the weir

Appendix A.5. Unadjusted summer chum salmon counts at scheduled counting times, Nulato River weir, 2003.

Date	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1530	1600	1700	1800	1900	2000	2100	2200	2300	Total	Percent of Total
7/05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	685	-	-	685	3.9
7/06	-	-	-	-	-	-	-	307	-	-	-	-	-	-	-	409	-	-	396	-	-	407	-	-	1,519	8.5
7/07	-	-	-	-	-	-	-	519	-	-	-	197	-	-	-	396	-	-	357	-	-	348	-	-	1,817	10.2
7/08	-	-	-	-	-	-	-	215	-	-	-	-	-	-	-	-	-	-	-	-	-	395	-	-	610	3.4
7/09	-	-	-	-	-	-	-	254	-	-	-	142	-	-	-	319	-	-	320	-	-	350	-	-	1,385	7.8
7/10	-	-	-	-	-	-	-	278	-	-	-	104	-	-	-	79	-	-	122	-	-	162	-	-	745	4.2
7/11	-	-	-	-	-	-	-	90	-	-	-	20	-	-	-	-	-	-	210	-	-	208	-	-	528	3.0
7/12	-	-	-	-	-	-	-	178	-	-	-	83	-	-	-	177	-	-	204	-	-	579	-	-	1,221	6.9
7/13	-	-	-	-	-	-	-	48	-	-	-	139	-	-	-	146	-	-	509	-	-	588	-	-	1,430	8.1
7/14	-	-	-	-	-	-	-	271	-	-	-	277	-	-	-	-	-	-	253	-	-	312	-	-	1,113	6.3
7/15	-	-	-	-	-	-	-	172	-	-	-	37	-	-	-	32	-	-	52	-	-	507	-	-	800	4.5
7/16	-	-	-	-	-	-	-	35	-	-	-	-	-	-	-	36	-	-	89	-	-	50	-	-	210	1.2
7/17	-	-	-	-	-	-	-	0	-	-	-	1	-	-	-	68	-	-	213	-	-	464	-	-	746	4.2
7/18	-	-	-	-	-	-	-	427	-	-	-	131	-	-	-	-	-	-	434	-	-	523	-	-	1,515	8.5
7/19	-	-	-	-	-	-	-	262	-	-	-	102	-	-	-	308	-	-	333	-	-	470	-	-	1,495	8.4
7/20	-	-	-	-	-	-	-	158	-	-	-	81	-	-	-	-	-	-	336	-	-	221	-	-	796	4.5
7/21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	430	-	-	167	-	-	218	-	-	835	4.7
7/22	-	-	-	-	-	-	-	77	-	-	-	24	-	-	-	98	-	-	113	-	-	-	-	-	312	1.8
Total	0	0	0	0	0	0	0	3,311	0	0	0	1,338	0	0	0	2,488	0	0	4,126	0	0	6,487	0	0	17,792	100.0

[ ] = did not count

Appendix A.6. Final summer chum salmon counts at Nulato River weir, 2003. Missed counts interpolated as indicated.

Date	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1530	1600	1700	1800	1900	2000	2100	2200	2300	Total	Percent of Total
7/05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	685	-	-	685	3.5
7/06	-	-	-	-	-	-	-	307	-	-	-	-	-	-	-	409	-	-	396	-	-	407	-	-	1,519	7.8
7/07	-	-	-	-	-	-	-	519	-	-	-	197	-	-	-	396	-	-	357	-	-	348	-	-	1,817	9.3
7/08	-	-	-	-	-	-	-	215	-	-	-	169.5	-	-	-	357.5	-	-	338.5	-	-	395	-	-	1,475	7.5
7/09	-	-	-	-	-	-	-	254	-	-	-	142	-	-	-	319	-	-	320	-	-	350	-	-	1,385	7.1
7/10	-	-	-	-	-	-	-	278	-	-	-	104	-	-	-	79	-	-	122	-	-	162	-	-	745	3.8
7/11	-	-	-	-	-	-	-	90	-	-	-	20	-	-	-	126	-	-	210	-	-	208	-	-	656	3.3
7/12	-	-	-	-	-	-	-	178	-	-	-	83	-	-	-	177	-	-	204	-	-	579	-	-	1,221	6.2
7/13	-	-	-	-	-	-	-	48	-	-	-	139	-	-	-	146	-	-	509	-	-	588	-	-	1,430	7.3
7/14	-	-	-	-	-	-	-	271	-	-	-	277	-	-	-	89	-	-	253	-	-	312	-	-	1,202	6.1
7/15	-	-	-	-	-	-	-	172	-	-	-	37	-	-	-	32	-	-	52	-	-	507	-	-	800	4.1
7/16	-	-	-	-	-	-	-	35	-	-	-	19	-	-	-	36	-	-	89	-	-	50	-	-	229	1.2
7/17	-	-	-	-	-	-	-	0	-	-	-	1	-	-	-	68	-	-	213	-	-	464	-	-	746	3.8
7/18	-	-	-	-	-	-	-	427	-	-	-	131	-	-	-	168	-	-	434	-	-	523	-	-	1,703	8.7
7/19	-	-	-	-	-	-	-	262	-	-	-	102	-	-	-	308	-	-	333	-	-	470	-	-	1,485	7.6
7/20	-	-	-	-	-	-	-	158	-	-	-	81	-	-	-	369	-	-	336	-	-	221	-	-	1,165	5.9
7/21	-	-	-	-	-	-	-	117.5	-	-	-	52.5	-	-	-	430	-	-	167	-	-	218	-	-	1,005	5.1
7/22	-	-	-	-	-	-	-	77	-	-	-	24	-	-	-	98	-	-	113	-	-	-	-	-	312	1.6
Total	0	0	0	0	0	0	0	3,428	0	0	0	1,579	0	0	0	3,830	0	0	4,467	0	0	6,487	0	0	19,590	100.0

[ ] = did not count; unable to interpolate
339 = did not count, interpolated count = average of the hourly counts from the day before and the day after the missed count
98 = weir breached, minimal count; did not interpolate

[a] Unable to count - logistics; crew, supplies, fuel, or communication needs
[b] Unable to count - debris; large piece of moss drifted up against the weir, several panels underwater, not fish tight
[c] Unable to count - unspecified
[d] Minimal counts for 0700, 1100, and 1530 hours July 13. A couple of panels came off the rail. Weir not fish tight, fish passing underneath the panels. Attributed to high winds and increased boat traffic
[e] Minimal counts for 0700 hours July 14 and 0700, 1100 hours July 17. Found a hole under the rail that fish were passing through. Attributed to gravel washing away beneath the weir.
[f] Minimal counts for 0700 hours on July 19 and July 20. Two panels off the rail, weir not fish tight. Attributed to night time bear activity on the weir.

Appendix B.1. Historic daily and cumulative Nulato River chinook salmon escapement passage estimates and cumulative proportions, 1994-2003.
Note: 1994-2002 data were collected using counting towers; 2003 data collected using a resistence board weir.

	1994			1995			1996			1997		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun										0	0	0.00
21-Jun										0	0	0.00
22-Jun										0	0	0.00
23-Jun										20	20	0.00
24-Jun										16	36	0.01
25-Jun										16	52	0.01
26-Jun				4	4	0.00	12	12	0.02	32	84	0.02
27-Jun				4	8	0.01	12	24	0.03	52	136	0.03
28-Jun				0	8	0.01	8	32	0.04	84	220	0.05
29-Jun				0	8	0.01	4	36	0.05	136	356	0.07
30-Jun				0	8	0.01	8	44	0.06	144	500	0.10
1-Jul				8	16	0.01	12	56	0.07	144	644	0.13
2-Jul				0	16	0.01	8	64	0.08	172	816	0.17
3-Jul				12	28	0.02	13	77	0.10	184	1,000	0.21
4-Jul	0	0	0.00	24	52	0.04	19	96	0.13	344	1,344	0.28
5-Jul	3	3	0.00	64	116	0.08	24	120	0.16	336	1,680	0.35
6-Jul	6	9	0.01	44	160		48	168	0.22	352	2,032	0.42
7-Jul	72	81	0.05	36	196	0.14	40	208	0.28	308	2,340	0.49
8-Jul	72	153	0.09	8	204	0.14	8	216	0.29	368	2,708	0.56
9-Jul	60	213	0.12	16	220	0.16	12	228	0.30	212	2,920	0.61
10-Jul	216	429	0.24	52	272	0.19	108	336	0.44	344	3,264	0.68
11-Jul	208	637	0.35	100	372	0.26	36	372	0.49	128	3,392	0.71
12-Jul	120	757	0.42	52	424	0.30	80	452	0.60	152	3,544	0.74
13-Jul	84	841	0.47	112	536	0.38	52	504	0.67	290	3,834	0.80
14-Jul	92	933	0.52	84	620	0.44	48	552	0.73	108	3,942	0.82
15-Jul	100	1,033	0.58	56	676	0.48	16	568	0.75	252	4,194	0.87
16-Jul	112	1,145	0.64	60	736	0.52	36	604	0.80	184	4,378	0.91
17-Jul	92	1,237	0.69	164	900	0.64	64	668	0.88	108	4,486	0.93
18-Jul	96	1,333	0.74	56	956	0.68	16	684	0.90	52	4,538	0.94
19-Jul	100	1,433	0.80	56	1,012	0.72	16	700	0.93	68	4,606	0.96
20-Jul	104	1,537	0.86	76	1,088	0.77	24	724	0.96	116	4,722	0.98
21-Jul	44	1,581	0.88	92	1,180	0.84	24	748	0.99	44	4,766	0.99
22-Jul	51	1,632	0.91	56	1,236	0.88	8	756	1.00	45	4,811	1.00
23-Jul	40	1,672	0.93	28	1,264	0.90	0	756	1.00			
24-Jul	43	1,715	0.96	72	1,336	0.95	0	756	1.00			
25-Jul	28	1,743	0.97	48	1,384	0.98						
26-Jul	12	1,755	0.98	28	1,412	1.00						
27-Jul	8	1,763	0.98									
28-Jul	32	1,795	1.00									
29-Jul												
30-Jul												
31-Jul												
	1,795			1,412			756			4,811		

(Continued)

Appendix B.1. (p. 2 of 3)

	1998[a]			1999[b]			2000			2001		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun												
21-Jun												
22-Jun	0	0	0.00									
23-Jun	0	0	0.00									
24-Jun	8	8	0.01	0	0	0.00	0	0	0.00			
25-Jun	4	12	0.01	0	0	0.00	0	0	0.00			
26-Jun	4	16	0.01	0	0	0.00	0	0	0.00			
27-Jun	28	44	0.03	0	0	0.00	0	0	0.00			
28-Jun	88	132	0.09	0	0	0.00	28	28	0.03			
29-Jun	20	152	0.10	0	0	0.00	16	44	0.05			
30-Jun	12	164	0.11	0	0	0.00	20	64	0.07			
1-Jul	0	164	0.11	0	0	0.00	0	64	0.07			
2-Jul	20	184	0.12	0	0	0.00	0	64	0.07			
3-Jul	0	184	0.12	8	8	0.00	20	84	0.09			
4-Jul	0	184	0.12	48	56	0.03	104	188	0.21			
5-Jul	0	184	0.12	16	72	0.04	104	292	0.32			
6-Jul	36	220	0.15	52	124	0.06	68	360	0.39			
7-Jul	4	224	0.15	104	228	0.12	112	472	0.52			
8-Jul	84	308	0.20	94	322	0.17	68	540	0.59			
9-Jul	60	368	0.24	132	454	0.23	132	672	0.73			
10-Jul	84	452	0.30	154	608	0.31	16	688	0.75			
11-Jul	44	496	0.33	116	724	0.37	36	724	0.79			
12-Jul	92	588	0.39	128	852	0.44	72	796	0.87			
13-Jul	102	690	0.46	72	924	0.48	64	860	0.94			
14-Jul	184	874	0.58	76	1,000	0.51	28	888	0.97			
15-Jul	156	1,030	0.68	128	1,128	0.58	0	888	0.97			
16-Jul	76	1,106	0.74	136	1,264	0.65	0	888	0.97			
17-Jul	20	1,126	0.75	94	1,358	0.70	0	888	0.97			
18-Jul	76	1,202	0.80	64	1,422	0.73	0	888	0.97			
19-Jul	78	1,280	0.85	80	1,502	0.77	0	888	0.97			
20-Jul	72	1,352	0.90	82	1,584	0.82	0	888	0.97			
21-Jul	60	1,412	0.94	70	1,654	0.85	0	888	0.97			
22-Jul	72	1,484	0.99	59	1,713	0.88	0	888	0.97			
23-Jul	20	1,504	1.00	48	1,761	0.91	0	888	0.97			
24-Jul				20	1,781	0.92	8	896	0.98			
25-Jul				40	1,821	0.94	8	904	0.99			
26-Jul				34	1,855	0.95	4	908	0.99			
27-Jul				28	1,883	0.97	0	908	0.99			
28-Jul				24	1,907	0.98	8	916	1.00			
29-Jul				36	1,943	1.00						
30-Jul												
31-Jul												
	1,504			1,943			916					

(Continued)

	2002			2003		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun						
16-Jun						
17-Jun						
18-Jun						
19-Jun						
20-Jun						
21-Jun						
22-Jun						
23-Jun						
24-Jun						
25-Jun	8	8	0.00			
26-Jun	8	16	0.01			
27-Jun	60	76	0.03			
28-Jun	58	134	0.05			
29-Jun	96	230	0.09			
30-Jun	132	362	0.13			
1-Jul	52	414	0.15			
2-Jul	62	476	0.18			
3-Jul	64	540	0.20			
4-Jul	116	656	0.24			
5-Jul	96	752	0.28	36	36	0.02
6-Jul	240	992	0.37	314	350	0.18
7-Jul	200	1,192	0.44	144	494	0.25
8-Jul	106	1,298	0.48	86	580	0.29
9-Jul	164	1,462	0.54	123	703	0.35
10-Jul	204	1,666	0.62	54	757	0.38
11-Jul	132	1,798	0.67	36	793	0.40
12-Jul	180	1,978	0.73	104	897	0.45
13-Jul	154	2,132	0.79	86	983	0.49
14-Jul	96	2,228	0.83	73	1,056	0.53
15-Jul	76	2,304	0.85	58	1,114	0.56
16-Jul	64	2,368	0.88	64	1,178	0.59
17-Jul	44	2,412	0.89	106	1,284	0.64
18-Jul	32	2,444	0.91	137	1,421	0.71
19-Jul	36	2,480	0.92	212	1,633	0.82
20-Jul	40	2,520	0.93	209	1,842	0.92
21-Jul	60	2,580	0.96	142	1,983	0.99
22-Jul	40	2,620	0.97	14	1,997	1.00
23-Jul	56	2,676	0.99			
24-Jul	20	2,696	1.00			
25-Jul						
26-Jul						
27-Jul						
28-Jul						
29-Jul						
30-Jul						
31-Jul						
	2,696			1,997		

[a] Missed counting periods were interpolated for chinook salmon where sufficient data existed.

[b] High water deterred counting in 2001 except for a few days, which are not reported.

Appendix B.2. Historic daily and cumulative Nulato River summer chum salmon escapement passage estimates and cumulative proportions, 1994-2003.
Note: 1994-2002 data were collected using counting towers; 2003 data collected using a resistence board weir.

	1994			1995			1996			1997		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun										64	64	0.00
21-Jun				452	452	0.00	700	700	0.01	168	232	0.00
22-Jun				692	1,144	0.00	3,684	4,384	0.03	524	756	0.00
23-Jun				1,056	2,200	0.01	6,612	10,996	0.08	2,344	3,100	0.02
24-Jun				1,880	4,080	0.02	6,680	17,676	0.14	3,816	6,916	0.04
25-Jun				1,612	5,692	0.02	7,196	24,872	0.19	4,856	11,772	0.07
26-Jun				2,044	7,736	0.03	6,792	31,664	0.24	4,592	16,364	0.10
27-Jun				10,884	18,620	0.08	2,082	33,746	0.26	3,868	20,232	0.13
28-Jun				5,196	23,816	0.10	3,812	37,558	0.29	4,816	25,048	0.16
29-Jun	2,001	2,001	0.01	9,184	33,000	0.14	5,542	43,100	0.33	6,972	32,020	0.20
30-Jun	8,355	10,356	0.07	7,188	40,188	0.17	7,271	50,371	0.39	7,916	39,936	0.25
1-Jul	7,898	18,254	0.12	9,716	49,904	0.21	7,104	57,475	0.44	7,656	47,592	0.30
2-Jul	9,604	27,858	0.19	15,110	65,014	0.27	6,076	63,551	0.49	8,900	56,492	0.36
3-Jul	7,601	35,459	0.24	9,068	74,082	0.31	3,624	67,175	0.52	8,596	65,088	0.41
4-Jul	6,708	42,167	0.28	11,064	85,146	0.36	5,484	72,659	0.56	12,432	77,520	0.49
5-Jul	10,188	52,355	0.35	12,700	97,846	0.41	8,320	80,979	0.62	11,432	88,952	0.56
6-Jul	8,092	60,447	0.41	18,504	116,350	0.49	4,968	85,947	0.66	10,748	99,700	0.63
7-Jul	7,008	67,455	0.45	10,704	127,054	0.54	7,460	93,407	0.72	11,368	111,068	0.70
8-Jul	4,704	72,159	0.49	11,960	139,014	0.59	5,728	99,135	0.76	9,944	121,012	0.77
9-Jul	9,232	81,391	0.55	14,008	153,022	0.65	3,664	102,799	0.79	4,664	125,676	0.79
10-Jul	10,744	92,135	0.62	14,004	167,026	0.71	7,104	109,903	0.85	7,388	133,064	0.84
11-Jul	8,776	100,911	0.68	13,684	180,710	0.76	4,144	114,047	0.88	3,756	136,820	0.87
12-Jul	7,327	108,238	0.73	11,356	192,066	0.81	4,224	118,271	0.91	4,153	140,973	0.89
13-Jul	6,931	115,169	0.77	8,660	200,726	0.85	3,888	122,159	0.94	3,558	144,531	0.91
14-Jul	6,535	121,704	0.82	5,172	205,898	0.87	3,132	125,291	0.97	2,256	146,787	0.93
15-Jul	6,140	127,844	0.86	4,232	210,130	0.89	1,920	127,211	0.98	3,016	149,803	0.95
16-Jul	4,440	132,284	0.89	6,728	216,858	0.92	916	128,127	0.99	3,016	152,819	0.97
17-Jul	3,211	135,495	0.91	6,464	223,322	0.94	676	128,803	0.99	2,392	155,211	0.98
18-Jul	3,332	138,827	0.93	3,716	227,038	0.96	520	129,323	1.00	924	156,135	0.99
19-Jul	2,215	141,042	0.95	4,400	231,438	0.98	371	129,694	1.00	1,080	157,215	0.99
20-Jul	1,712	142,754	0.96	3,368	234,806	0.99				760	157,975	1.00
21-Jul	1,208	143,962	0.97	2,084	236,890	1.00				196	158,171	1.00
22-Jul	2,808	146,770	0.99									
23-Jul	1,992	148,762	1.00									
24-Jul												
25-Jul												
26-Jul												
27-Jul												
28-Jul												
29-Jul												
30-Jul												
31-Jul												
Total	148,762			236,890			129,694			158,171		

(Continued)

	1998[a]			1999[b]			2000			2001		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun												
21-Jun												
22-Jun	0	0	0.00									
23-Jun	4	4	0.00									
24-Jun	36	40	0.00	0	0	0.00	4	4	0.00			
25-Jun	56	96	0.00	0	0	0.00	148	152	0.01			
26-Jun	180	276	0.01	0	0	0.00	284	436	0.01			
27-Jun	588	864	0.02	0	0	0.00	240	676	0.02			
28-Jun	770	1,634	0.03	0	0	0.00	364	1,040	0.04			
29-Jun	722	2,356	0.05	0	0	0.00	672	1,712	0.06			
30-Jun	716	3,072	0.06	0	0	0.00	200	1,912	0.07			
1-Jul	708	3,780	0.07	24	24	0.00	244	2,156	0.07			
2-Jul	496	4,276	0.08	12	36	0.00	220	2,376	0.08			
3-Jul	1,092	5,369	0.10	256	292	0.01	1,256	3,632	0.12			
4-Jul	1,688	7,057	0.14	720	1,012	0.03	2,940	6,572	0.22			
5-Jul	2,284	9,342	0.18	1,964	2,976	0.10	2,564	9,136	0.31			
6-Jul	2,880	12,222	0.23	2,220	5,196	0.17	2,104	11,240	0.38			
7-Jul	1,584	13,806	0.27	2,876	8,072	0.27	1,472	12,712	0.43			
8-Jul	2,752	16,558	0.32	2,368	10,440	0.34	1,168	13,880	0.47			
9-Jul	2,192	18,750	0.36	1,716	12,156	0.40	1,468	15,348	0.52			
10-Jul	4,768	23,518	0.45	2,122	14,278	0.47	1,004	16,352	0.56			
11-Jul	2,712	26,230	0.50	2,096	16,374	0.54	1,916	18,268	0.62			
12-Jul	2,292	28,522	0.55	2,092	18,466	0.61	2,056	20,324	0.69			
13-Jul	4,384	32,906	0.63	1,140	19,606	0.65	1,596	21,920	0.75			
14-Jul	4,860	37,766	0.73	1,008	20,614	0.68	968	22,888	0.78			
15-Jul	3,804	41,570	0.80	1,296	21,910	0.72	881	23,769	0.81			
16-Jul	2,780	44,350	0.85	1,332	23,242	0.77	796	24,565	0.84			
17-Jul	1,288	45,638	0.88	1,204	24,446	0.81	711	25,276	0.86			
18-Jul	1,856	47,494	0.91	1,100	25,546	0.84	623	25,899	0.88			
19-Jul	734	48,228	0.93	912	26,458	0.87	533	26,432	0.90			
20-Jul	1,340	49,568	0.95	650	27,108	0.90	455	26,887	0.92			
21-Jul	1,144	50,712	0.97	582	27,690	0.91	360	27,247	0.93			
22-Jul	816	51,528	0.99	513	28,203	0.93	273	27,520	0.94			
23-Jul	513	52,041	1.00	444	28,647	0.95	376	27,896	0.95			
24-Jul				420	29,067	0.96	308	28,204	0.96			
25-Jul				388	29,455	0.97	372	28,576	0.97			
26-Jul				311	29,766	0.98	330	28,906	0.98			
27-Jul				233	29,999	0.99	300	29,206	0.99			
28-Jul				156	30,155	1.00	160	29,366	1.00			
29-Jul				128	30,283	1.00						
30-Jul												
31-Jul												
Total	52,041			30,283			29,366					

(Continued)

	2002			2003		
Date	Daily Counts	Cum. Counts	Cum. Prop.	Daily Counts	Cum. Counts	Cum. Prop.
15-Jun						
16-Jun						
17-Jun						
18-Jun						
19-Jun						
20-Jun						
21-Jun						
22-Jun						
23-Jun	8	8	0.00			
24-Jun	186	194	0.00			
25-Jun	432	626	0.01			
26-Jun	1,120	1,746	0.02			
27-Jun	2,190	3,936	0.05			
28-Jun	3,028	6,964	0.10			
29-Jun	4,276	11,240	0.16			
30-Jun	3,291	14,531	0.20			
1-Jul	2,312	16,843	0.23			
2-Jul	2,951	19,794	0.27			
3-Jul	2,826	22,620	0.31			
4-Jul	4,212	26,832	0.37			
5-Jul	4,432	31,264	0.43	685	685	0.03
6-Jul	5,296	36,560	0.51	1,519	2,204	0.11
7-Jul	5,296	41,856	0.58	1,817	4,021	0.21
8-Jul	3,836	45,692	0.63	1,476	5,496	0.28
9-Jul	4,056	49,748	0.69	1,385	6,881	0.35
10-Jul	3,536	53,284	0.74	745	7,626	0.39
11-Jul	2,280	55,564	0.77	656	8,282	0.42
12-Jul	2,516	58,080	0.80	1,221	9,503	0.49
13-Jul	2,594	60,674	0.84	1,430	10,933	0.56
14-Jul	2,202	62,876	0.87	1,202	12,135	0.62
15-Jul	1,840	64,716	0.90	800	12,935	0.66
16-Jul	1,828	66,544	0.92	229	13,164	0.67
17-Jul	1,426	67,970	0.94	746	13,910	0.71
18-Jul	1,030	69,000	0.96	1,703	15,613	0.80
19-Jul	806	69,806	0.97	1,495	17,108	0.87
20-Jul	992	70,798	0.98	1,165	18,273	0.93
21-Jul	564	71,362	0.99	1,005	19,278	0.98
22-Jul	476	71,838	0.99	312	19,590	1.00
23-Jul	332	72,170	1.00			
24-Jul	60	72,230	1.00			
25-Jul						
26-Jul						
27-Jul						
28-Jul	[a]					
29-Jul						
30-Jul						
31-Jul						
	72,230			19,590		

[a] Missed counting periods were interpolated for summer chum salmon where sufficient data existed.

[b] High water deterred counting in 2001 except for a

Appendix C.1. Nulato River weir summer chum salmon age and sex composition by stratum and weighted seasonal total, 2003.

Sample Dates	Sample Size			Brood Year and (Age Group) 2000 (0.2)	1999 (0.3)	1998 (0.4)	1997 (0.5)	Total
8-9 Jul	120	Males	No. of escapement	0	3,305	1,334	127	4,766
			Percent of sample	0	43.3	17.5	1.7	62.5
		Females	No. of escapement	127	2,478	191	64	2,860
			Percent of sample	1.7	32.5	2.5	0.8	37.5
		Subtotal	No. of escapement	127	5,783	1,525	191	7,626
			Percent of sample	1.7	75.8	20.0	2.5	100.0
11-14 Jul	129	Males	No. of escapement	0	2,533	687	43	3,263
			Percent of sample	0.0	45.7	12.4	0.8	58.9
		Females	No. of escapement	0	1,889	386	0	2,275
			Percent of sample	0.0	34.1	7.0	0.0	41.1
		Subtotal	No. of escapement	0	4,422	1,073	43	5,538
			Percent of sample	0.0	79.8	19.4	0.8	100.0
18-Jul	128	Males	No. of escapement	0	2,962	401	0	3,363
			Percent of sample	0.0	46.1	6.3	0.0	52.3
		Females	No. of escapement	201	2,410	452	0	3,063
			Percent of sample	3.1	37.5	7.0	0.0	47.7
		Subtotal	No. of escapement	201	5,372	853	0	6,426
			Percent of sample	3.1	83.6	13.3	0.0	100.0
Seasonal	377	Males	No. of escapement	0	8,800	2,423	170	11,393
			Percent of sample	0.0	44.9	12.4	0.9	58.2
		Females	No. of escapement	328	6,777	1,029	64	8,197
			Percent of sample	1.7	34.6	5.2	0.3	41.8
		Total	No. of escapement	328	15,577	3,452	234	19,590
			Percent of sample	1.7	79.5	17.6	1.2	100.0
Mean Length		Males		.	568	609	647	
Std. Error				.	2	5	13	
Mean Length		Females		521	539	569	550	
Std. Error				3	2	5	.	